Powerware®

9155 UPS

8–15 kVA

USER'S GUIDE

www.powerware.com

POWERWARE®

Class A EMC Statements

FCC Part 15

NOTE This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

ICES-003

This Class A Interference Causing Equipment meets all requirements of the Canadian Interference Causing Equipment Regulations ICES-003.

Cet appareil numérique de la classe A respecte toutes les exigences du Reglement sur le matériel brouilleur du Canada.

IEC 62040-2

Some configurations are classified under IEC 62040-2 as “Class-A UPS for Unrestricted Sales Distribution.” For these configurations, the following applies:

WARNING This is a Class A-UPS Product. In a domestic environment, this product may cause radio interference, in which case, the user may be required to take additional measures.

VCCI Notice

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Requesting a Declaration of Conformity

Units that are labeled with a CE mark comply with the following harmonized standards and EU directives:

- Harmonized Standards: IEC 62040-1-1 and IEC 62040-2; IEC 60950 Third Edition
- EU Directives:
  73/23/EEC, Council Directive on equipment designed for use within certain voltage limits
  93/68/EEC, Amending Directive 73/23/EEC
  89/336/EEC, Council Directive relating to electromagnetic compatibility
  92/31/EEC, Amending Directive 89/336/EEC relating to EMC

The EC Declaration of Conformity is available upon request for products with a CE mark. For copies of the EC Declaration of Conformity, contact:

Eaton Power Quality Oy
Koskelontie 13
FIN-02920 Espoo
Finland
Phone: +358-9-452 661
Fax: +358-9-452 665 68

Special Symbols

The following are examples of symbols used on the UPS to alert you to important information:

RISK OF ELECTRIC SHOCK - Indicates that a risk of electric shock is present and the associated warning should be observed.

CAUTION: REFER TO OPERATOR'S MANUAL - Refer to your operator's manual for additional information, such as important operating and maintenance instructions.

This symbol indicates that you should not discard the UPS or the UPS batteries in the trash. This product contains sealed, lead-acid batteries and must be disposed of properly. For more information, contact your local recycling/reuse or hazardous waste center.

This symbol indicates that you should not discard waste electrical or electronic equipment (WEEE) in the trash. For proper disposal, contact your local recycling/reuse or hazardous waste center.

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Chapter 1 Introduction

The Powerware® 9155 is a double-conversion, split-phase, online uninterruptible power system (UPS) for protecting computer systems and other intelligent devices. It is ideal for protecting essential information technology and electrical engineering infrastructure in corporate, telecom, health care, banking, and industrial applications.

The UPS provides a steady, well-regulated power supply for your computing and communications equipment, while protecting it from the frequent irregularities that are inherent in commercially available power. Voltage spikes, power surges, brownouts, and power failures have the potential to corrupt critical data, destroy unsaved work sessions, and in some instances, damage expensive hardware.

With the Powerware 9155, you can safely eliminate the effects of electrical line disturbances and guard the integrity of your systems and equipment. Figure 1 shows the Powerware 9155 UPS and an optional Extended Battery Module (EBM).

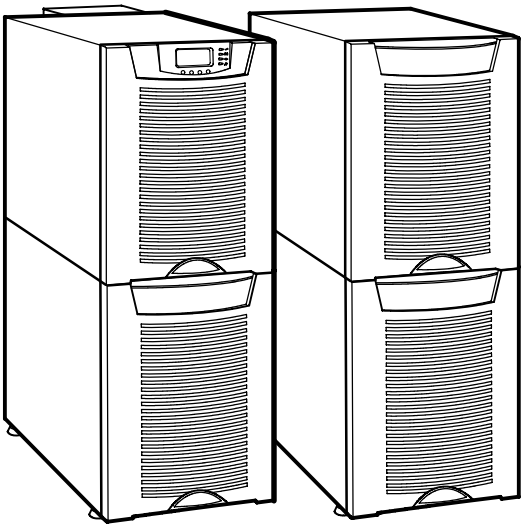

Figure 1. The Powerware 9155 UPS and EBM (2-High Cabinets Shown)

Providing outstanding performance and reliability, the Powerware 9155's unique benefits including the following:

- Online UPS design with pure sine wave output. The UPS filters and regulates incoming AC power and provides consistent power to your equipment without draining the battery.
- More wattage in less space with a 0.9 power factor – protecting more equipment and leaving more room for expansion.
- Support for Powerware Hot Sync™ paralleling of multiple modules for redundancy or extra capacity.
- Input current total harmonic distortion (THD) of less than five percent, using active input power factor correction.
- ABM® technology that uses advanced battery management to increase battery service life, optimize recharge time, and provide a warning before the end of useful battery life.
- Up to four hours of extended runtime with added EBMs.
- Advanced power management with the Powerware Software Suite CD for graceful shutdowns and power monitoring.
- Emergency shutdown control through the Remote Emergency Power-off (REPO) port.
- Start-on-battery capability for powering up the UPS even if utility power is not available.
- Standard communication options with a DB-9 serial port, relay output contacts, and programmable signal inputs.
- Optional X-Slot™ cards enhance communication capabilities for increased power protection and control.
- Backed by worldwide agency approvals.

The following options for the Powerware 9155 are available:

- **Maintenance Bypass Module (MBM)**

  The optional MBM is installed on the UPS rear panel and is used to bypass the UPS during maintenance or servicing. The Maintenance Bypass switch on the MBM provides a Make-Before-Break (MBB) wrap-around bypass for UPS service without shutting down the load.

- **Power Distribution Module (PDM)**

  The optional PDM provides the same functionality as the MBM and also comes equipped with several different types of output receptacles.

- **Wall-Mounted Bypass Switch**

  The optional wall-mounted bypass switch is used to bypass the UPS during maintenance or servicing, providing wrap-around bypass for UPS service without shutting down the load.

- **Parallel Tie Cabinet**

  A parallel system with up to three UPSs can be installed to provide a parallel capacity and/or redundant system. This load sharing system provides more capacity than a single UPS and can provide backup, depending on the load and configuration. In addition, when one UPS is taken out of service for maintenance or is not operating properly, a redundant UPS continues to supply uninterrupted power to the critical load. A parallel Powerware Hot Sync Computer Area Network (CAN) Bridge Card provides connectivity for system metering and operational mode control. The parallel system consists of two to three UPSs, each with a parallel CAN Bridge Card, and a parallel tie cabinet. Refer to the *Powerware 9155 Parallel UPS (8–15 kVA) User's Guide* for more information.

- **Input Isolation Transformer**

  The optional input isolation transformer is located at the bottom of a 3-high UPS model. The input isolation transformer provides a neutral from a 208V or 240V input source with 240V output and can be wired to the UPS or to an MBM/PDM.

- **Seismic Kit**

  The seismic kit secures the UPS and optional EBMs for Zone 4 seismic installations.

Chapter 2 Safety Warnings

The only user operations permitted are:

- Starting up and shutting down the UPS
- Operating the user interface
- Connecting data interface cables
- Monitoring the UPS with power management software

IMPORTANT SAFETY INSTRUCTIONS SAVE THESE INSTRUCTIONS

This manual contains important instructions that you should follow during installation and maintenance of the UPS and batteries. Please read all instructions before operating the equipment and save this manual for future reference.

DANGER

This UPS contains **LETHAL VOLTAGES**. All repairs and service should be performed by **AUTHORIZED SERVICE PERSONNEL ONLY**. There are **NO USER SERVICEABLE PARTS** inside the UPS.

WARNING

- This UPS contains its own energy source (batteries). The UPS output may carry live voltage even when the UPS is not connected to an AC supply.
- To reduce the risk of fire or electric shock, install this UPS in a temperature and humidity controlled, indoor environment, free of conductive contaminants. Ambient temperature must not exceed 40°C (104°F). Do not operate near water or excessive humidity (95% max).
- To reduce the risk of fire, connect only to a circuit provided with 100 amperes maximum branch circuit overcurrent protection in accordance with the National Electrical Code, ANSI/NFPA 70.
- Output overcurrent protection and disconnect switch must be provided by others.

CAUTION

- Batteries can present a risk of electrical shock or burn from high short circuit current. Observe proper precautions. Servicing should be performed by qualified service personnel knowledgeable of batteries and required precautions. Keep unauthorized personnel away from batteries.
- Proper disposal of batteries is required. Refer to your local codes for disposal requirements.
- Never dispose of batteries in a fire. Batteries may explode when exposed to flame.

Consignes de Sécurité

CONSIGNES DE SÉCURITÉ IMPORTANTES
CONSERVER CES INSTRUCTIONS
CE MANUEL CONTIENT DES CONSIGNES DE SÉCURITÉ IMPORTANTES

DANGER!

Cet onduleur contient des TENSIONS MORTELLES. Toute opération d'entretien et de réparation doit être EXCLUSIVEMENT CONFIÉE A UN PERSONNEL QUALIFIÉ AGRÉÉ. AUCUNE PIÈCE RÉPARABLE PAR L'UTILISATEUR ne se trouve dans l'onduleur.

WARNING

- Cet onduleur renferme sa propre source d'énergie (batteries). Les prises de sortie peuvent être sous tension même lorsque l'onduleur n'est pas branché sur le secteur.
- Pour réduire les risques d'incendie et de décharge électrique, installer l'onduleur uniquement à l'intérieur, dans un lieu dépourvu de matériaux conducteurs, où la température et l'humidité ambiantes sont contrôlées. La température ambiante ne doit pas dépasser 40 °C. Ne pas utiliser à proximité d'eau ou dans une atmosphère excessivement humide (95 % maximum).
- La protection contre une surintensité pour le(s) circuit(s) de sortie de courant alternatif doit être fournie par un autre fournisseur.
- Les interrupteurs de déconnexion convenables pour le(s) circuit(s) de sortie de courant alternatif doivent être fournie par un autre fournisseur.

ATTENTION!

- Les batteries peuvent présenter un risque de décharge électrique ou de brûlure par des courts-circuits de haute intensité. Prendre les précautions nécessaires.
- Une mise au rebut réglementaire des batteries est obligatoire. Consulter les règlements en vigueur dans votre localité.
- Ne jamais jeter les batteries au feu. L'exposition aux flammes risque de les faire exploser.

Advertencias de Seguridad

INSTRUCCIONES DE SEGURIDAD IMPORTANTES GUARDE ESTAS INSTRUCCIONES ESTE MANUAL CONTIENE INSTRUCCIONES DE SEGURIDAD IMPORTANTES

PELIGRO

Este SIE contiene VOLTAJES MORTALES. Todas las reparaciones y el servicio técnico deben ser efectuados SOLAMENTE POR PERSONAL DE SERVICIO TÉCNICO AUTORIZADO. No hay NINGUNA PARTE QUE EL USUARIO PUEDA REPARAR dentro del SIE.

WARNING

- Este SIE contiene su propia fuente de energía (las baterías). Los receptáculos de salida pueden transmitir corriente eléctrica aun cuando el SIE no esté conectado a un suministro de corriente alterna (c.a.).
- Para reducir el riesgo de incendio o de choque eléctrico, instale este SIE en un lugar cubierto, con temperatura y humedad controladas, libre de contaminantes conductores. La temperatura ambiente no debe exceder los 40°C. No trabaje cerca del agua o con humedad excesiva (95% máximo).
- La protección contra exceso de corriente para el/los circuito(s) de CA de salida será suministrada por terceros.
- Los interruptores de desconexión debidamente clasificados para el/los circuito(s) de CA de salida serán suministrados por terceros.

PRECAUCIÓN

- Las baterías pueden presentar un riesgo de descargas eléctricas o de quemaduras debido a la alta corriente de cortocircuito. Preste atención a las instrucciones correspondientes.
- Es necesario desechar las baterías de un modo adecuado. Consulte las normas locales para conocer los requisitos pertinentes.
- Nunca deseche las baterías en el fuego. Las baterías pueden explotar si se las expone a la llama.

Chapter 3 | UPS Setup

This chapter describes:

- Equipment inspection
- Floor loading
- Unloading the cabinet(s)
- Selecting an installation option

The instructions are intended for the chief operator/system supervisor, electrical consultants, and installation electricians. Local regulations and electrical code must be followed during the UPS installation.

Inspecting the Equipment

If any equipment has been damaged during shipment, keep the shipping and packing materials for the carrier or place of purchase and file a claim for shipping damage. If you discover damage after acceptance, file a claim for concealed damage.

To file a claim for shipping damage or concealed damage: 1) File with the carrier within 15 days of receipt of the equipment; 2) Send a copy of the damage claim within 15 days to your service representative.

NOTE *Check the battery recharge date on the packaging label. If the date has expired and the batteries were never recharged, do not use the UPS. Contact your service representative.*

Floor Loading

When planning the installation, consider the UPS weight for floor loading. The strength of the installation surface must be adequate for point and distributed loadings. The approximate weights are shown in the following table.

Standard Model Floor Loadings (2-High/3-High Cabinets)			
Powerware 9155	Maximum Weight (lb)	Point Loading (lb/in^2)	Distributed Loading (lb/ft^2)
2-High UPS	352	88	166
3-High UPS	590	148	278
3-High UPS with Isolation Transformer	558	140	263
2-High EBM	480	120	226
3-High EBM	710	178	335

Clearances

The following clearances are recommended for the Powerware 9155 UPS:

From Front of Cabinet	36″ (91.4 cm) working space
From Back of Cabinet	6″ (15.2 cm) without MBM/PDM installed; with MBM/PDM installed, clearance determined by customer-supplied mating plug

Unloading the Cabinet(s)

The following tools are required for unloading the cabinet(s):

- 15 mm wrench or socket
- 7 mm nutdriver or socket

CAUTION

The UPS and EBM are heavy (see page 10). Unloading the cabinets requires at least two people to safely remove the cabinets from the pallet.

To remove the UPS or EBM from the shipping pallet:

1. Remove the two M10 bolts securing the stabilizing bracket to the pallet (see Figure 2).

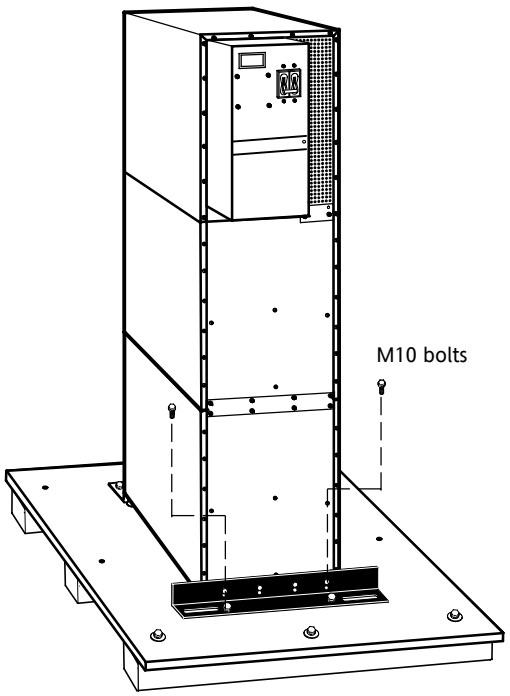

Figure 2. Removing the Stabilizing Bracket Bolts

2. Remove the four M4 screws securing the stabilizing bracket to the cabinet rear panel and remove the bracket (see Figure 3). Retain the hardware for later use.

NOTE *Be sure to retain the stabilizing bracket and hardware for later re-assembly onto the cabinet.*

3. Remove the three M10 bolts securing the rear shipping pad to the pallet and remove the shipping pad (see Figure 3).

NOTE *Hold the back of the cabinet so that the bolts can be removed easily without the cabinet rolling backward.*

4. Remove the two M10 bolts securing the front shipping bracket and remove the bracket (see Figure 3).

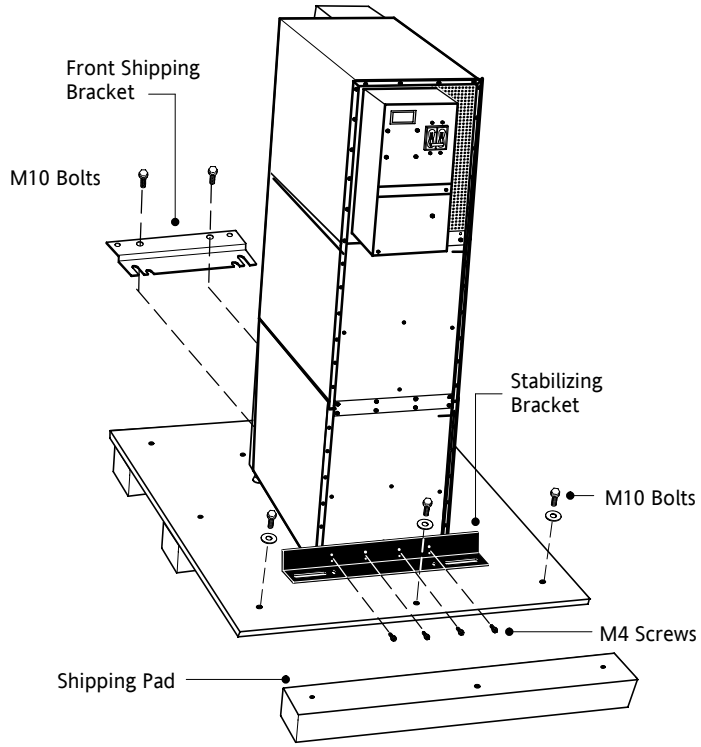

Figure 3. Removing the Brackets and Shipping Pad

NOTE *Be sure to support the front and back of the cabinet when rolling it off the pallet to prevent tipping.*

5. Slowly roll the cabinet toward the rear of the pallet. Once the pallet tilts, continue rolling the cabinet down the pallet until the cabinet is clear of the pallet (see Figure 4).

   If needed, adjust the leveling feet so that the cabinet will roll.

6. Roll the cabinet to the desired location.

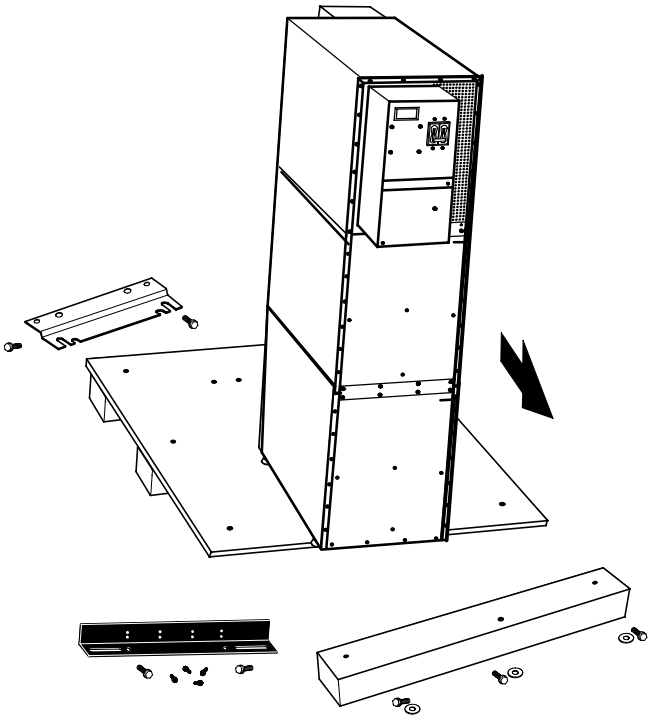

Figure 4. Unloading the Cabinet

Selecting an Installation Option

You are now ready to install the Powerware 9155 UPS. Select one of the following installation options according to your UPS configuration:

UPS Configuration	Installation Chapter
UPS only	Chapter 4, “UPS Only Installation” on page 15
UPS with an optional input isolation transformer	Chapter 5, “Input Isolation Transformer Installation” on page 21
UPS with an optional UPS-mounted bypass switch	Chapter 6, “UPS-Mounted Bypass Switch Installation” on page 29
UPS with an optional wall-mounted bypass switch	Chapter 7, “Wall-Mounted Bypass Switch Installation” on page 39
Parallel UPS configuration	Refer to the *Powerware 9155 Parallel UPS (8–15 kVA) User’s Guide*.

Chapter 4 UPS Only Installation

The Powerware 9155 has the following power connections:

- 2-phase (L1 and L2), neutral, and ground connection for rectifier/bypass input
- 2-phase (L1 and L2), neutral, and ground connection for load output

The nominal input/output voltages are:

- 100/200, 110/220, or 120/240 Vac with 180° phase displacement
- 120/208 or 127/220 Vac with 120° phase displacement

Output overcurrent protection and disconnect switch must be provided by others.

Figure 7 on page 19 shows a oneline diagram of the UPS.

WARNING

Only qualified service personnel (such as a licensed electrician) should perform the UPS installation and initial startup. Risk of electrical shock.

Use the following procedure to hardwire the UPS:

1. Verify that the electrical connections to the installation site have been properly installed.
2. A wall-mounted, user-supplied, readily-accessible disconnection device must be incorporated in the input wiring.

   Compare the circuit breaker ratings and wire sizes to the ones in the following wiring table:

Table 1. Circuit Breaker Ratings

UPS Capacity	Input Circuit Breaker Rating	Minimum Wire Size*
8 kVA	60A	4 AWG (21.2 mm^2)
10 kVA	80A	3 AWG (26.7 mm^2)
12 kVA	100A	2 AWG (33.6 mm^2)
15 kVA	100A	2 AWG (33.6 mm^2)

*Use only 90°C-rated copper wire. Minimum wire size is based on 120/208 full load ratings applied to NEC Code Table 310-16. Code may require a larger AWG size than shown in this table because of temperature, number of conductors in the conduit, or long service runs. Follow local requirements.

NOTE *To accommodate the feature of easy system expandability, it is recommended that initial installation of the Powerware 9155 UPS contain wiring to support the maximum capacity of the UPS cabinet.*

3. Switch off utility power to the distribution point where the UPS will be connected. Be absolutely sure there is no power.
4. Determine your equipment's grounding requirements according to your local electrical code.
5. Verify that the UPS battery circuit breaker is in the OFF position (see Figure 5).

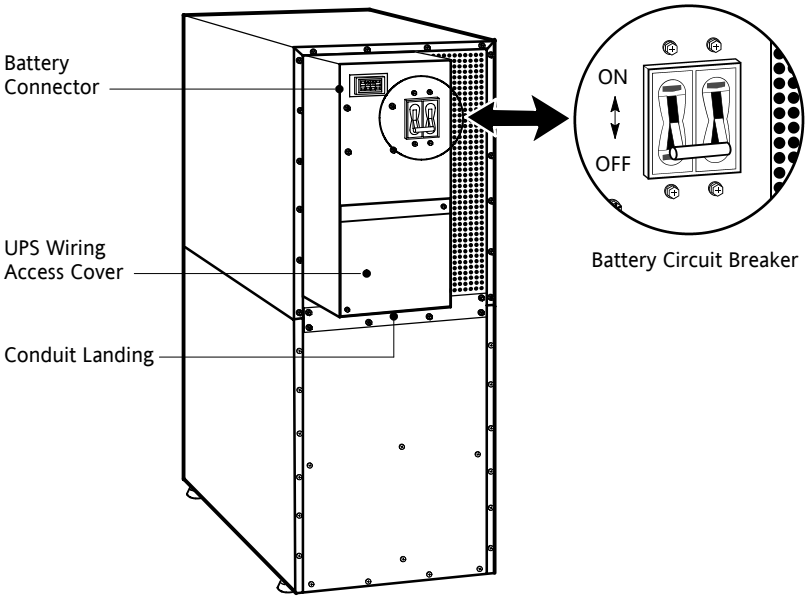

Figure 5. UPS Rear View

6. Remove the UPS wiring access cover and retain (see Figure 5).

7. Hardwire the input (TB1-1 through TB1-5) and output (TB1-6 through TB1-9) terminations for the UPS.

   See Table 2 for specifications and Figure 6 for a detailed view of the UPS terminal block.

NOTE *Input neutral must be wired for proper operation.*

Table 2. UPS Terminal Block Wiring

Wire Function		Terminal Position	Minimum Wire Size*	Tightening Torque	Conduit Connection (Entry Size)
Input	Ground	TB1-1	8 AWG	25 lb in (2.83 Nm)	2″ access hole for 1-1/2″ conduit
	L1	TB1-3	3 AWG		
	Neutral	TB1-4	3 AWG		
	L2	TB1-5	3 AWG		
Output	L1	TB1-6	3 AWG	25 lb in (2.83 Nm)	2″ access hole for 1-1/2″ conduit
	Neutral	TB1-7	3 AWG		
	L2	TB1-8	3 AWG		
	Ground	TB1-9	8 AWG		

*Use only 90°C-rated copper wire. Minimum wire size is based on 120/208 full load ratings applied to NEC Code Table 310-16.

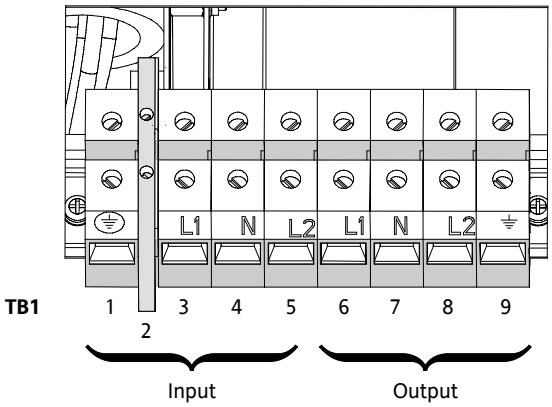

Figure 6. UPS Terminal Block

8. Replace the UPS wiring access cover.

9. Continue to “Stabilizing the Cabinet” on page 49 to complete the UPS installation.

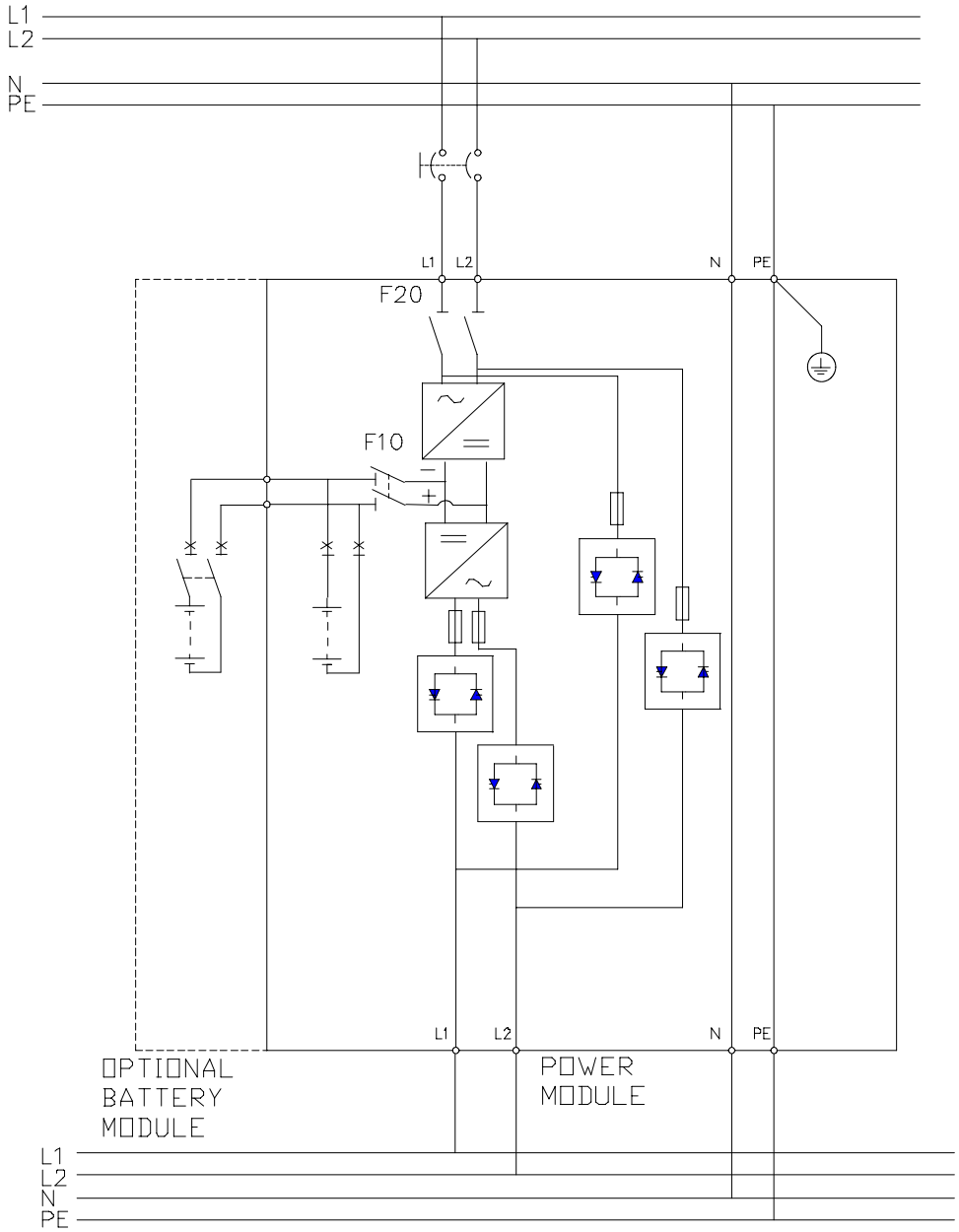

Figure 7. UPS Only Wiring Diagram

Chapter 5 Input Isolation Transformer Installation

The Powerware 9155 has the following power connections:

- 2-phase (L1 and L2), neutral, and ground connection for rectifier/bypass input
- 2-phase (L1 and L2), neutral, and ground connection for load output

CAUTION

- The input isolation transformer output is always 240V (180° phase angle).
- If installing an MBM/PDM, the UPS MUST be set up for 240V output only; otherwise, the "Bypass Not Available" alarm annunciates. Any equipment connected to the output requiring 208V (120° phase angle) is at risk for damage when using the Maintenance Bypass switch.
- The input isolation transformer cannot be used with a wall-mounted bypass switch.

Output overcurrent protection and disconnect switch must be provided by others.

Figure 11 and Figure 12 beginning on page 27 show the oneline diagrams of the input isolation transformer with the UPS.

WARNING

Only qualified service personnel (such as a licensed electrician) should perform the UPS installation and initial startup. Risk of electrical shock.

Use the following procedure to hardwire the input isolation transformer and UPS. All hardware is supplied in the accessory kit.

1. Verify that the electrical connections to the installation site have been properly installed.
2. A wall-mounted, user-supplied, readily-accessible disconnection device must be incorporated in the input wiring.

   Compare the circuit breaker ratings and wire sizes to the ones in the following wiring table:

Table 3. Circuit Breaker Ratings

UPS Capacity	Input Circuit Breaker Rating	Minimum Wire Size*
8 kVA	60A	4 AWG (21.2 mm^2)
10 kVA	80A	3 AWG (26.7 mm^2)
12 kVA	100A	2 AWG (33.6 mm^2)
15 kVA	100A	2 AWG (33.6 mm^2)

*Use only 90°C-rated copper wire. Minimum wire size is based on 120/208 full load ratings applied to NEC Code Table 310-16. Code may require a larger AWG size than shown in this table because of temperature, number of conductors in the conduit, or long service runs. Follow local requirements.

NOTE *To accommodate the feature of easy system expandability, it is recommended that initial installation of the Powerware 9155 UPS contain wiring to support the maximum capacity of the UPS cabinet.*

3. Switch off utility power to the distribution point where the UPS will be connected. Be absolutely sure there is no power.
4. Determine your equipment's grounding requirements according to your local electrical code.
5. Verify that the UPS battery circuit breaker is in the OFF position (see Figure 8).

6. Verify that the input circuit breaker is in the OFF position.
7. Remove the UPS wiring access cover and retain.
8. Remove the input isolation transformer wiring cover and retain.

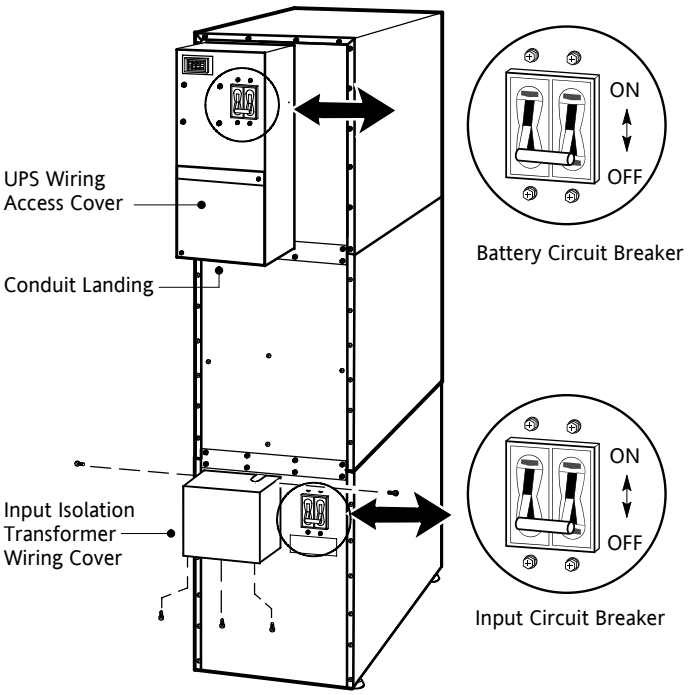

Figure 8. UPS with Input Isolation Transformer Rear View

9. If you are also installing an optional Maintenance Bypass Module or Power Distribution Module, proceed to Step 15 on page 26; otherwise, continue to Step 10.
10. On the input isolation transformer, punch the two pilot holes in the conduit landing for the input and output conduit using a Greenlee® punch or similar device (see Figure 9).
11. Hardwire the input, output, and ground terminations for the input isolation transformer.

    See Table 4 for specifications and Figure 9 for a detailed view of the input isolation transformer terminal block.

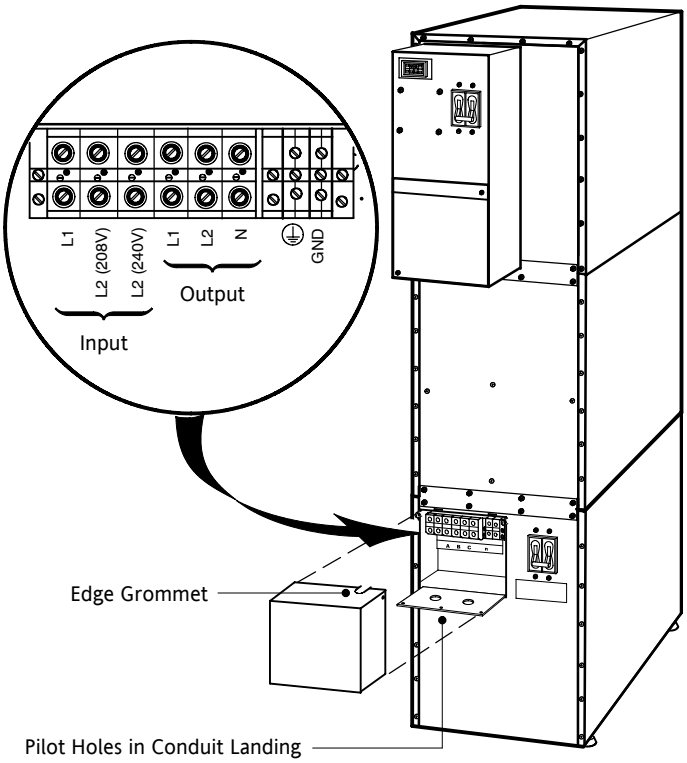

Figure 9. Input Isolation Transformer Hardwiring

NOTE *Input neutral is supplied by the input isolation transformer.*

Table 4. Input Isolation Transformer Terminal Block Wiring

Wire Function		Terminal Position	Minimum Wire Size*	Tightening Torque
Input	L1	TB1-1	2 AWG	25 lb in (2.83 Nm)
	L2 (208V)	TB1-2	2 AWG	
	L2 (240V)	TB1-3	2 AWG	
Output	L1	TB1-4	3 AWG	25 lb in (2.83 Nm)
	L2	TB1-5	3 AWG	
	Neutral	TB1-6	3 AWG	
Ground	Output	TB1-7	8 AWG	25 lb in (2.83 Nm)
Ground	Input	TB1-8	8 AWG	

*Use only 90°C-rated copper wire. Minimum wire size is based on 120/208 full load ratings applied to NEC Code Table 310-16. Code may require a larger AWG size than shown in this table because of temperature, number of conductors in the conduit, or long service runs. Follow local requirements.

12. Wire the output of the input isolation transformer terminal block to the UPS input terminal block (see Table 5 and Figure 10).

Table 5. UPS Terminal Block Wiring

Wire Function		Terminal Position	Minimum Wire Size*	Tightening Torque	Conduit Connection (Entry Size)
Input	Ground	TB1-1	8 AWG	25 lb in (2.83 Nm)	2″ access hole for 1-1/2″ conduit
	L1	TB1-3	3 AWG		
	Neutral	TB1-4	3 AWG		
	L2	TB1-5	3 AWG		
Output	L1	TB1-6	3 AWG	25 lb in (2.83 Nm)	2″ access hole for 1-1/2″ conduit
	Neutral	TB1-7	3 AWG		
	L2	TB1-8	3 AWG		
	Ground	TB1-9	8 AWG		

*Use only 90°C-rated copper wire. Minimum wire size is based on 120/208 full load ratings applied to NEC Code Table 310-16.

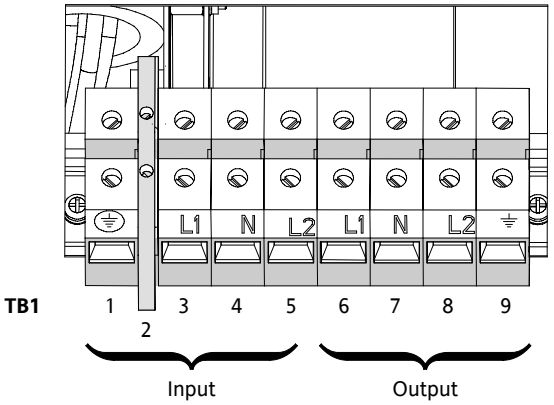

Figure 10. UPS Terminal Block

13. Replace the UPS wiring access cover and the input isolation transformer wiring cover.

14. Continue to "Stabilizing the Cabinet" on page 49 to complete the UPS installation.

15. On the input isolation transformer, punch one pilot hole in the conduit landing for the input conduit using a Greenlee punch or similar device (see Figure 9 on page 24).

16. Install the supplied edge grommet in the top of the input isolation transformer wiring cover.

17. Hardwire the input (TB1-1 through TB1-3) terminations for the input isolation transformer.

See Table 4 for specifications and Figure 9 for a detailed view of the input isolation transformer terminal block.

18. Punch a hole in the bottom of the MBM/PDM using a Greenlee punch or similar device for wiring access.

Insert the supplied nylon bushing inside the wiring access hole.

19. Continue to the following chapter, "UPS-Mounted Bypass Switch Installation," to complete the installation.

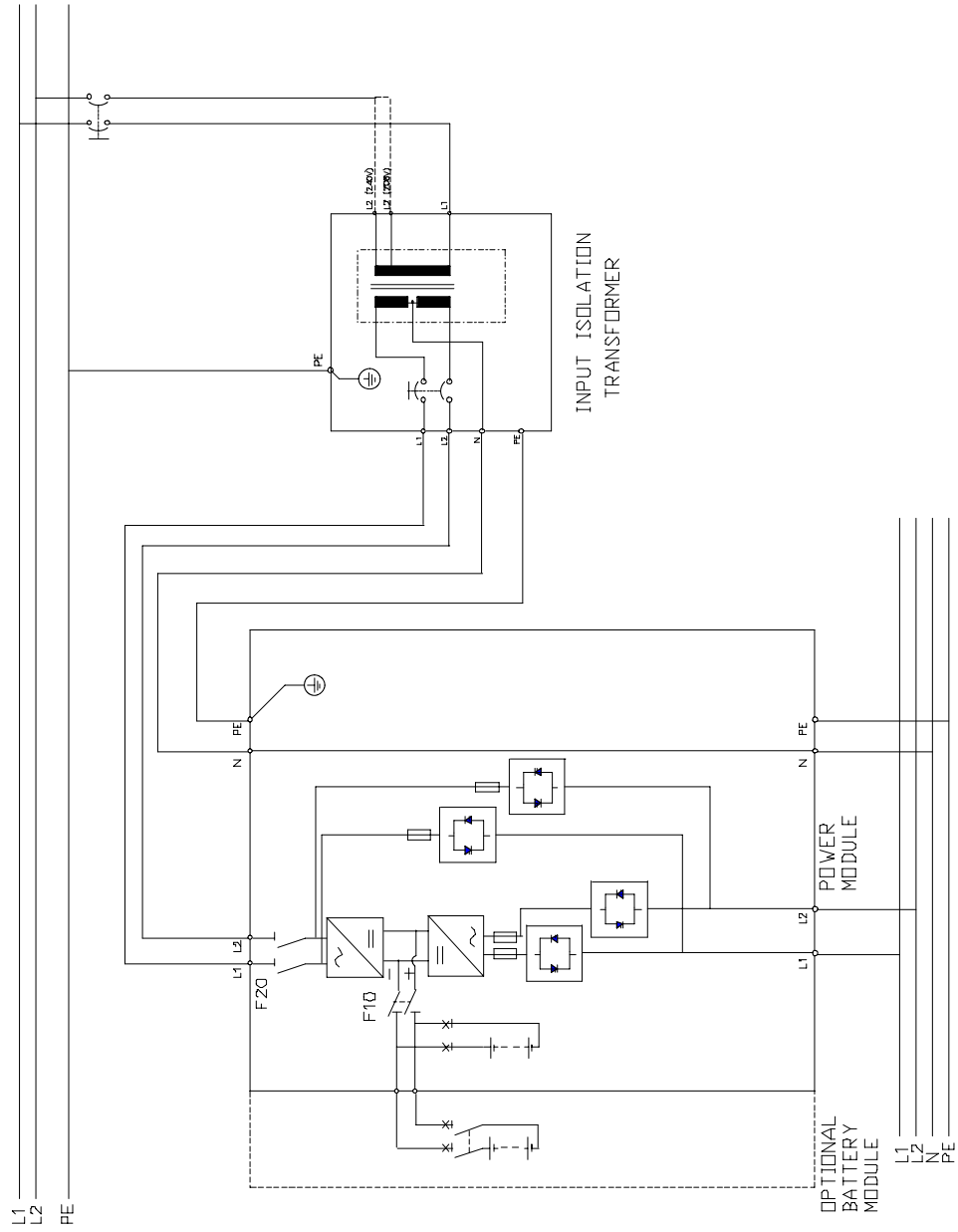

Figure 11. UPS with Input Isolation Transformer Wiring Diagram

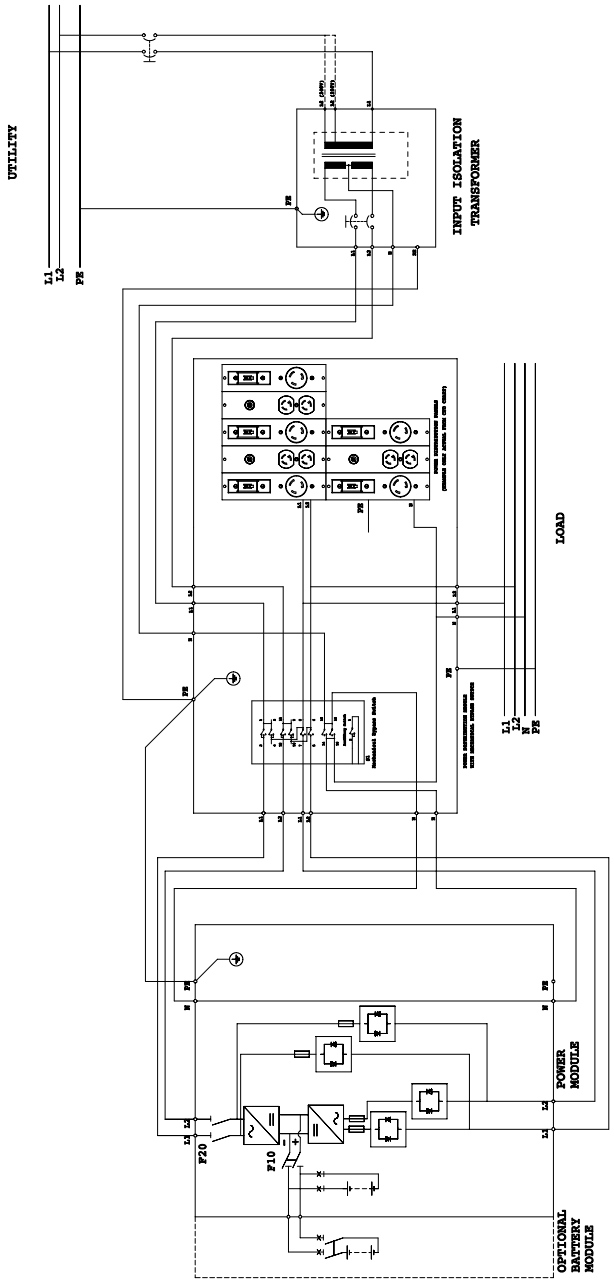

Figure 12. UPS with Input Isolation Transformer and MBM/PDM Wiring Diagram

Chapter 6 | UPS-Mounted Bypass Switch Installation

This chapter describes the Maintenance Bypass Module and Power Distribution Module installation. Both modules have a Make-Before-Break Maintenance Bypass switch.

Maintenance Bypass/Power Distribution Module Setup

If you purchased an optional MBM/PDM, attach the module to the UPS before any wiring installation. All hardware is supplied in the accessory kit. Use the following procedure to attach the optional MBM/PDM to the UPS:

1. Remove the connecting plate between the top cabinet and the cabinet below it on the UPS rear panel (see Figure 13). Discard the plate. Retain the screws for later use.

2. Remove the lowest top cover screw on each side of the UPS and discard.

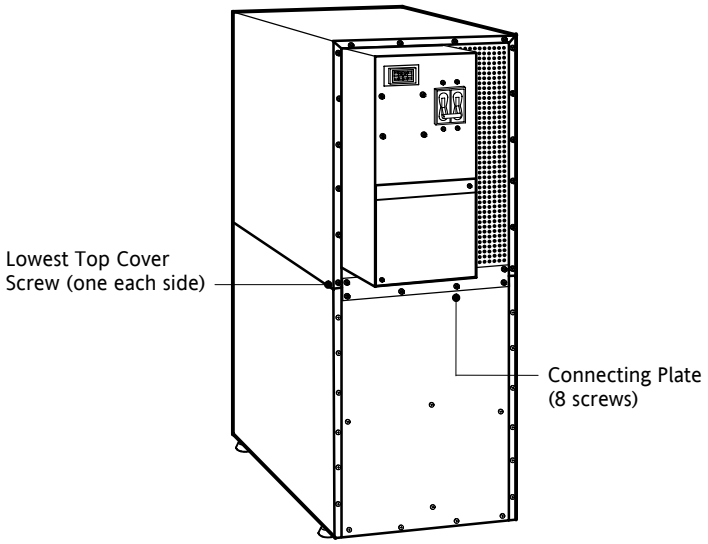

Figure 13. UPS Rear View (2-High Cabinet Shown)

3. Attach the supplied L-bracket to the lower rear (for 2-high) or middle rear (for 3-high) cabinet using three screws (see Figure 14).

Repeat for the other side.

4. Remove the UPS wiring access cover and retain.

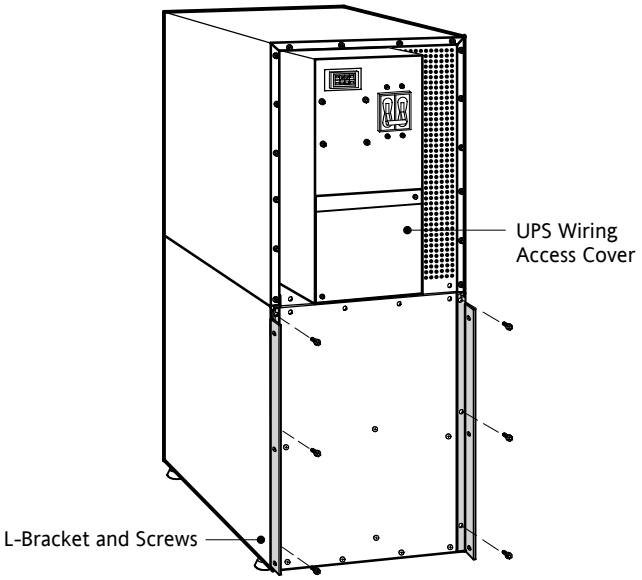

Figure 14. Attaching the L-Brackets

5. Insert the two supplied nylon bushings inside the wiring access holes on the UPS conduit landing plate (see Figure 15).

6. Remove the MBM/PDM wiring access cover and the conduit landing plate and retain.

7. Tilt the top of the module forward and slide the module onto the L-brackets. The top left flange on the module fits up under the UPS electronics unit through an access slot.

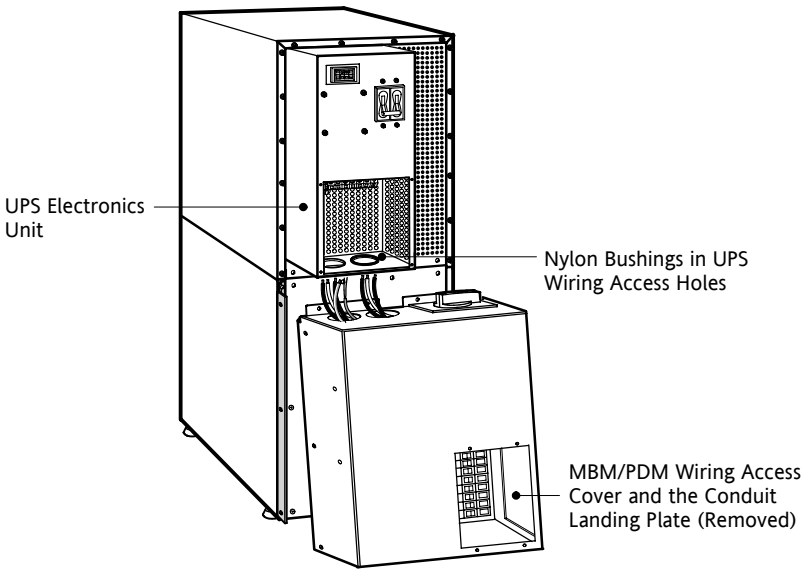
UPS Electronics Unit
Nylon Bushings in UPS Wiring Access Holes
MBM/PDM Wiring Access Cover and the Conduit Landing Plate (Removed)

Figure 15. Installing the MBM or PDM (MBM Shown)

8. Secure the sides of the module to the L-brackets using six screws (see Figure 16).

9. Secure the top of the module to the top cabinet using four of the screws removed in Step 1.

10. Continue to the following section, “Wiring the MBM/PDM.”

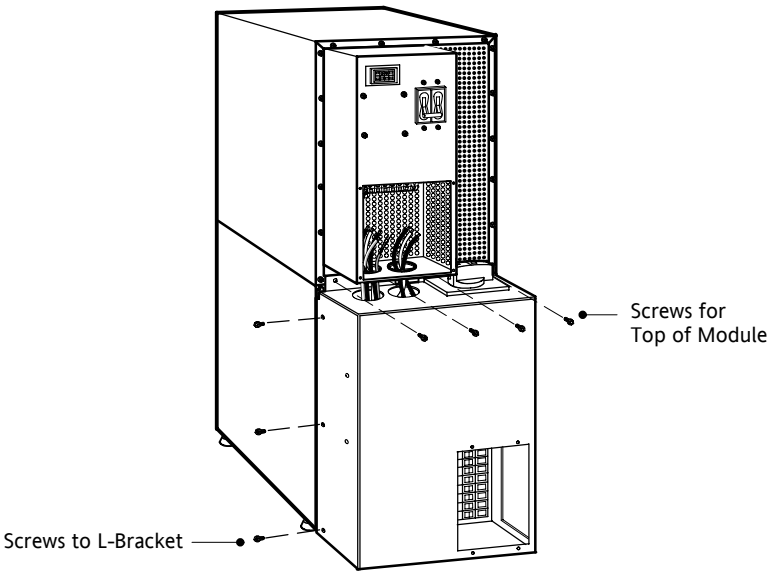

Figure 16. Attaching the L-Brackets

Wiring the MBM/PDM

The Powerware 9155 UPS has the following power connections:

- 2-phase (L1 and L2), neutral, and ground connection for rectifier/bypass input
- 2-phase (L1 and L2), neutral, and ground connection for load output

The nominal input/output voltages are:

- 100/200, 110/220, or 120/240 Vac with 180° phase displacement
- 120/208 or 127/220 Vac with 120° phase displacement

Output overcurrent protection and disconnect switch must be provided by others.

Figure 20 and Figure 21 beginning on page 37 show the oneline diagrams of the MBM and PDM with the UPS.

WARNING

Only qualified service personnel (such as a licensed electrician) should perform the UPS installation and initial startup. Risk of electrical shock.

Use the following procedure to hardwire the MBM/PDM:

1. Verify that the electrical connections to the installation site have been properly installed.
2. A wall-mounted, user-supplied, readily-accessible disconnection device must be incorporated in the input wiring.

   Compare the circuit breaker ratings and wire sizes to the ones in the following wiring table:

Table 6. Circuit Breaker Ratings

UPS Capacity	Input Circuit Breaker Rating	Minimum Wire Size*
8 kVA	60A	4 AWG (21.2 mm^2)
10 kVA	80A	3 AWG (26.7 mm^2)
12 kVA	100A	2 AWG (33.6 mm^2)
15 kVA	100A	2 AWG (33.6 mm^2)

*Use only 90°C-rated copper wire. Minimum wire size is based on 120/208 full load ratings applied to NEC Code Table 310-16. Code may require a larger AWG size than shown in this table because of temperature, number of conductors in the conduit, or long service runs. Follow local requirements.

NOTE *To accommodate the feature of easy system expandability, it is recommended that initial installation of the Powerware 9155 UPS contain wiring to support the maximum capacity of the UPS cabinet.*

3. Switch off utility power to the distribution point where the UPS will be connected. Be absolutely sure there is no power.

4. Determine your equipment's grounding requirements according to your local electrical code.

5. Verify that the UPS battery circuit breaker is in the OFF position (see Figure 17).

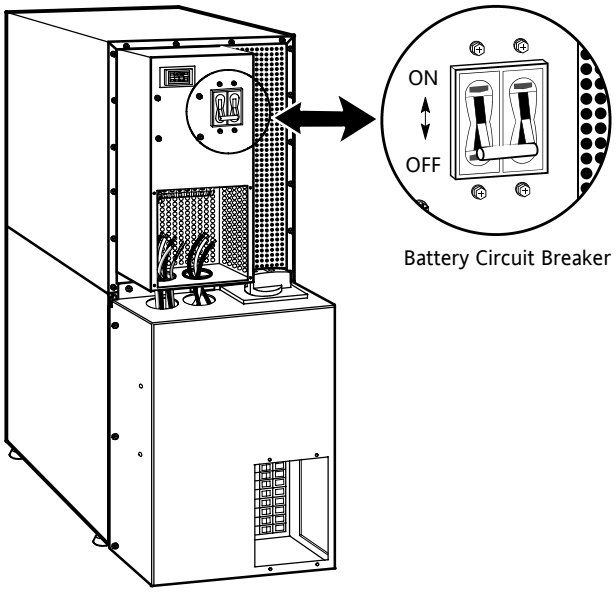

Figure 17. UPS with MBM Rear View

6. Punch two holes in the MBM/PDM conduit landing plate for the input and output conduit using a Greenlee punch or similar device.

7. Hardwire the input (TB10-1 through TB10-4) and output (TB10-5 through TB10-8) terminations for the MBM/PDM.

   See Table 7 for specifications and Figure 18 for a detailed view of the MBM/PDM terminal block.

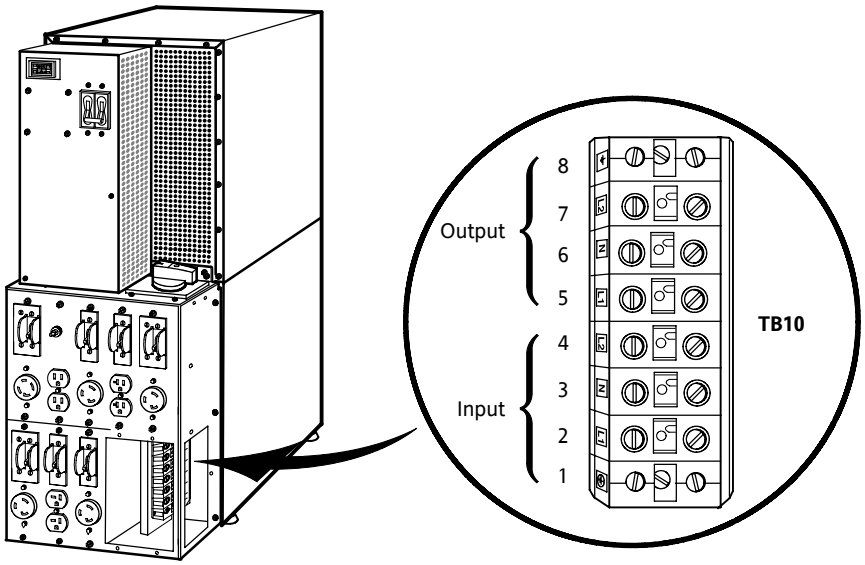

Figure 18. MBM/PDM Hardwiring (PDM Shown)

NOTE *Input neutral must be wired for proper operation. However, when wired with the optional isolation transformer, input neutral is supplied by the isolation transformer.*

Table 7. MBM/PDM Terminal Block Wiring

Wire Function		Terminal Position	Minimum Wire Size*	Tightening Torque	Conduit Connection (Entry Size)
Input	Ground	TB10-1	8 AWG	25 lb in (2.83 Nm)	2″ access hole for 1-1/2″ conduit
	L1	TB10-2	3 AWG		
	Neutral	TB10-3	3 AWG		
	L2	TB10-4	3 AWG		
Output	L1	TB10-5	3 AWG	25 lb in (2.83 Nm)	2″ access hole for 1-1/2″ conduit
	Neutral	TB10-6	3 AWG		
	L2	TB10-7	3 AWG		
	Ground	TB10-8	8 AWG		

*Use only 90°C-rated copper wire. Minimum wire size is based on 120/208 full load ratings applied to NEC Code Table 310-16.

8. Connect the factory-installed wiring from the Maintenance Bypass switch to the UPS terminal block (see Figure 19).

Connect the maintenance bypass (red and black) wires to TB1-2 (the A/B maintenance bypass auxiliary contacts) on the UPS terminal block.

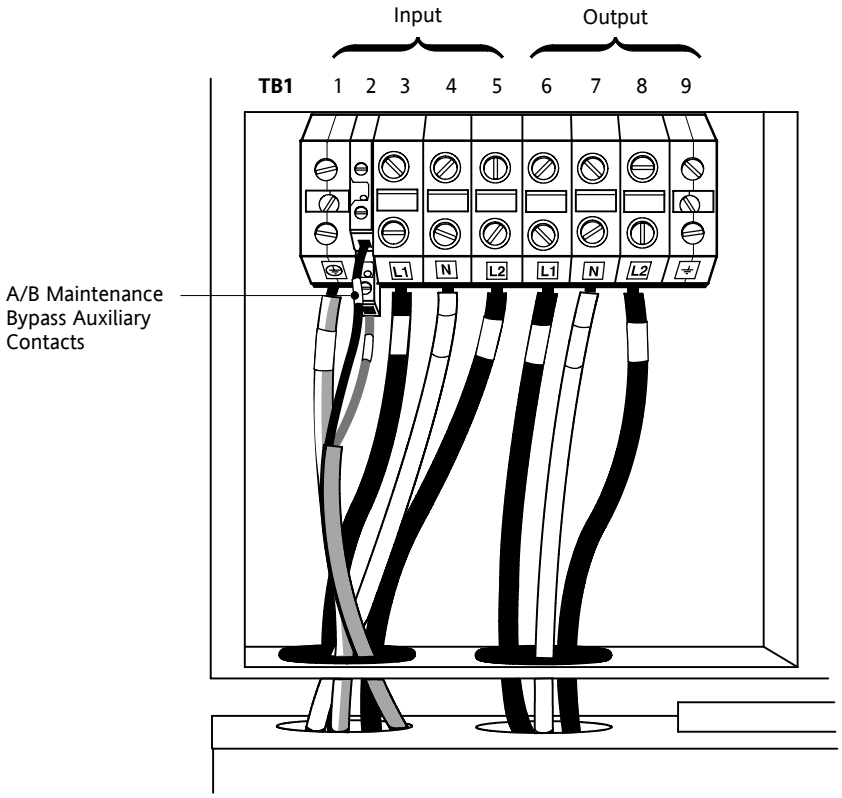

Figure 19. Wiring from Maintenance Bypass Switch to UPS

9. Replace the wiring access cover on the UPS and the optional isolation transformer, if applicable.

10. Replace the MBM/PDM wiring access cover and conduit landing plate.

11. Continue to “Stabilizing the Cabinet” on page 49 to complete the installation.

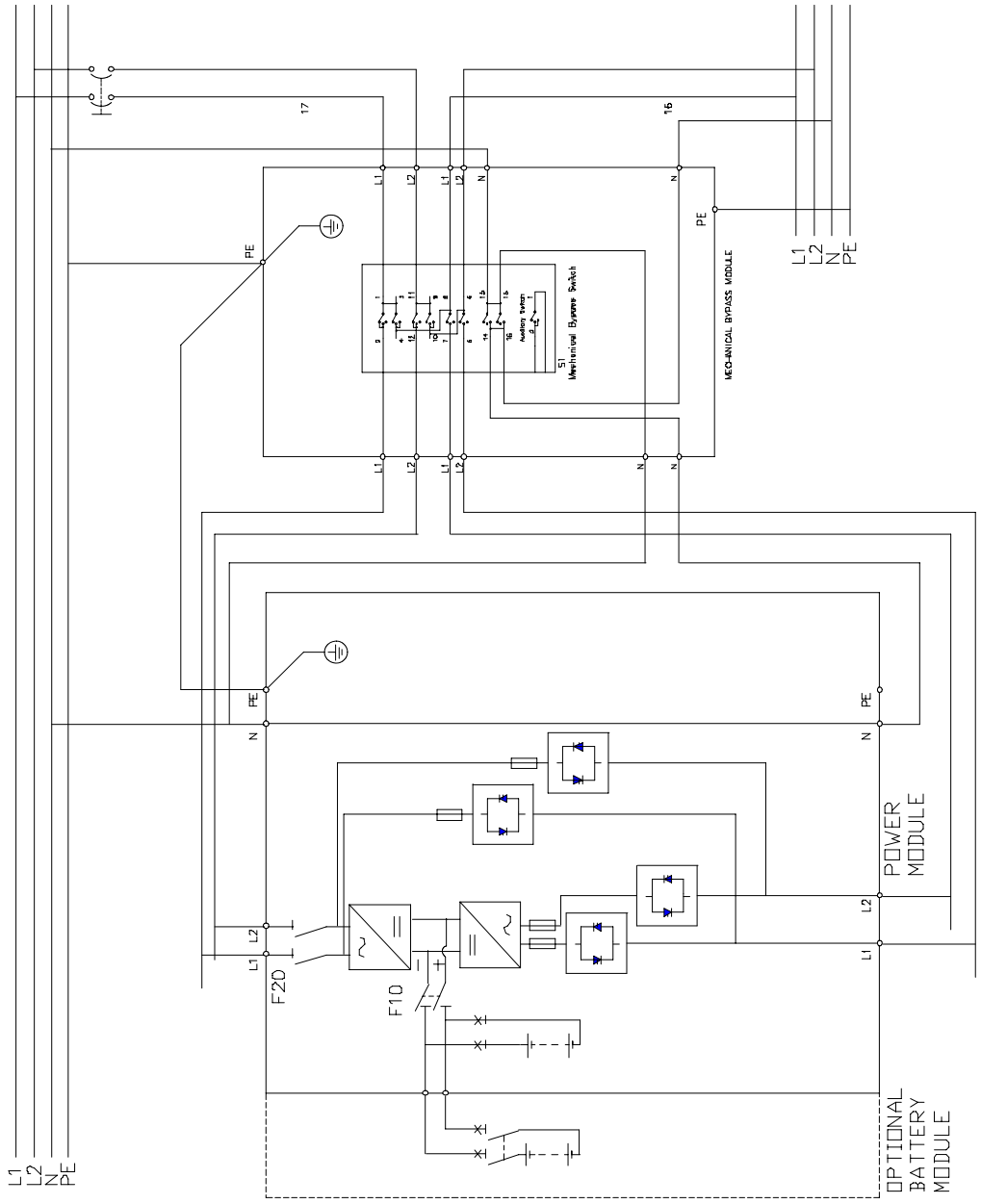

Figure 20. UPS with MBM Wiring Diagram

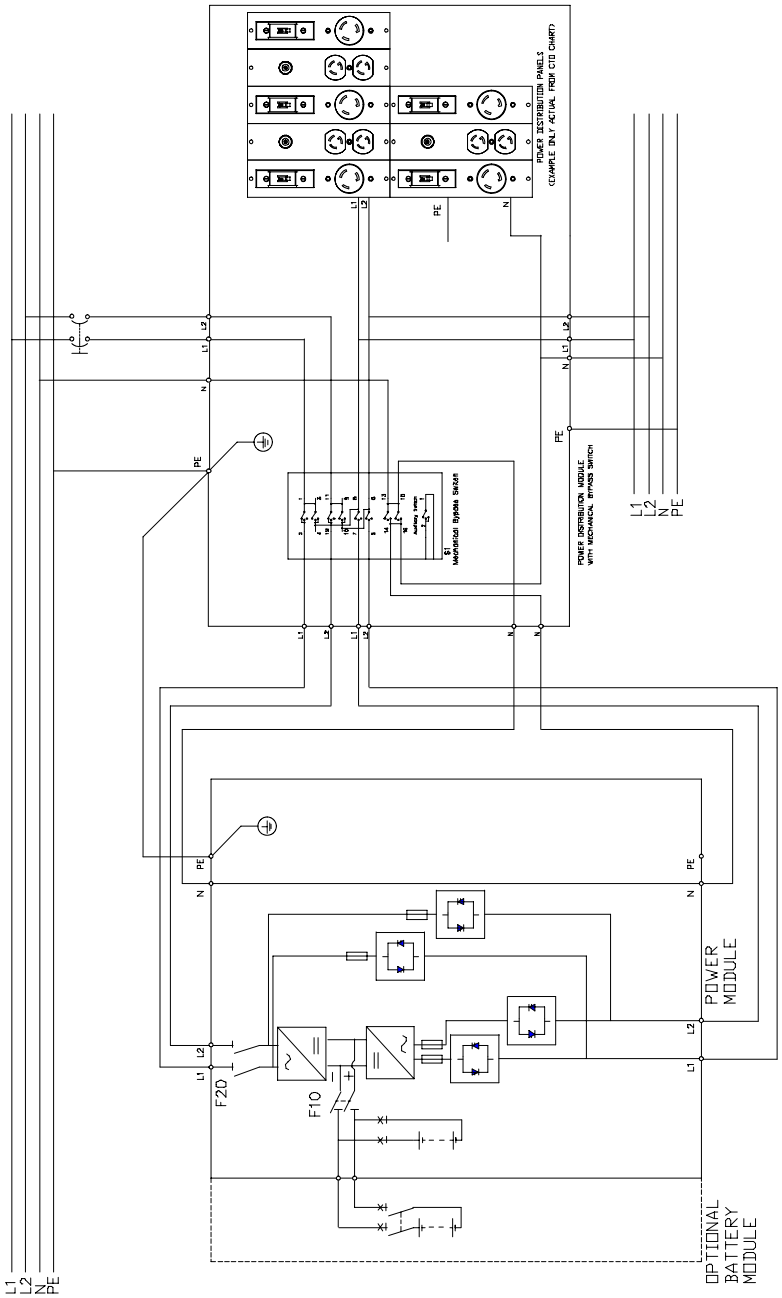

Figure 21. UPS with PDM Wiring Diagram

Chapter 7 Wall-Mounted Bypass Switch Installation

This chapter describes the wall-mounted bypass switch installation with the UPS. The wall-mounted bypass switch is a Make-Before-Break Maintenance Bypass switch.

NOTE *The input isolation transformer cannot be used with the wall-mounted bypass swtich.*

Figure 22 shows the wall-mounted bypass switch and dimensions.

Dimension		Measurement
Height	(A)	21.0″ (53.4 cm)
Width	(B)	14.0″ (35.6 cm)
Depth	(C)	6.8″ (17.2 cm)
Mounting Centers	(D)	11.0″ (28.0 cm)
	(E)	20.0″ (50.8 cm)
Weight		31 lb (14.1 kg)

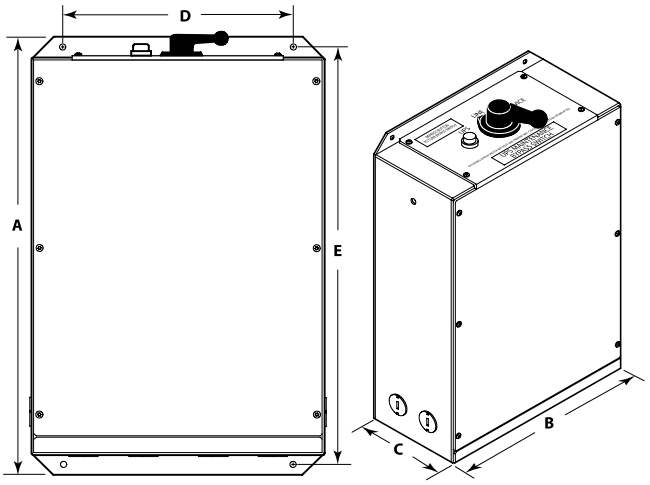

Figure 22. Wall-Mounted Bypass Switch Dimensions

Wall-Mounted Bypass Switch Setup

Use the following procedure to set up the wall-mounted bypass switch:

1. Remove the knockouts in the bottom or side of the bypass switch for AC Line Input, AC to UPS Input, AC from UPS Output, and AC to the UPS load (see Figure 23).

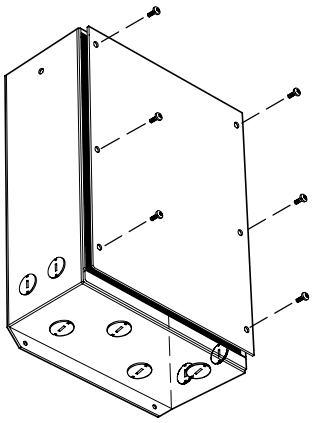

Figure 23. Wall-Mounted Bypass Switch Knockouts

2. Mount the bypass switch cabinet to a sturdy surface within sight of the UPS. You may need to rotate the cabinet 90 degrees to enable operator access to the switch handle.

3. Remove the six screws from the bypass switch front cover and remove the cover (see Figure 23).

4. Remove and discard any packing material from inside the bypass switch.

Wiring the Wall-Mounted Bypass Switch

The Powerware 9155 UPS has the following power connections:

- 2-phase (L1 and L2), neutral, and ground connection for rectifier/bypass input
- 2-phase (L1 and L2), neutral, and ground connection for load output

The nominal input/output voltages are:

- 100/200, 110/220, or 120/240 Vac with 180° phase displacement
- 120/208 or 127/220 Vac with 120° phase displacement

Output overcurrent protection and disconnect switch must be provided by others.

Figure 28 on page 47 shows a oneline diagram of the UPS with a wall-mounted bypass switch.

WARNING

Only qualified service personnel (such as a licensed electrician) should perform the hardwired installation. Risk of electrical shock.

Use the following procedure to hardwire the wall-mounted bypass switch:

1. Verify that the electrical connections to the installation site have been properly installed.
2. A wall-mounted, user-supplied, readily-accessible disconnection device must be incorporated in the input wiring.

   Compare the circuit breaker ratings and wire sizes to the ones in the following wiring table:

Table 8. Circuit Breaker Ratings

UPS Capacity	Input Circuit Breaker Rating	Minimum Wire Size*
8 kVA	60A	4 AWG (21.2 mm^2)
10 kVA	80A	3 AWG (26.7 mm^2)
12 kVA	100A	2 AWG (33.6 mm^2)
15 kVA	100A	2 AWG (33.6 mm^2)

*Use only 90°C-rated copper wire. Minimum wire size is based on 120/208 full load ratings applied to NEC Code Table 310-16. Code may require a larger AWG size than shown in this table because of temperature, number of conductors in the conduit, or long service runs. Follow local requirements.

NOTE *To accommodate the feature of easy system expandability, it is recommended that initial installation of the Powerware 9155 UPS contain wiring to support the maximum capacity of the UPS cabinet.*

3. Switch off utility power to the distribution point where the UPS will be connected. Be absolutely sure there is no power.
4. Determine your equipment's grounding requirements according to your local electrical code.

5. Verify that the UPS battery circuit breaker is in the OFF position (see Figure 24).

6. Remove the UPS wiring access cover and retain (see Figure 24).

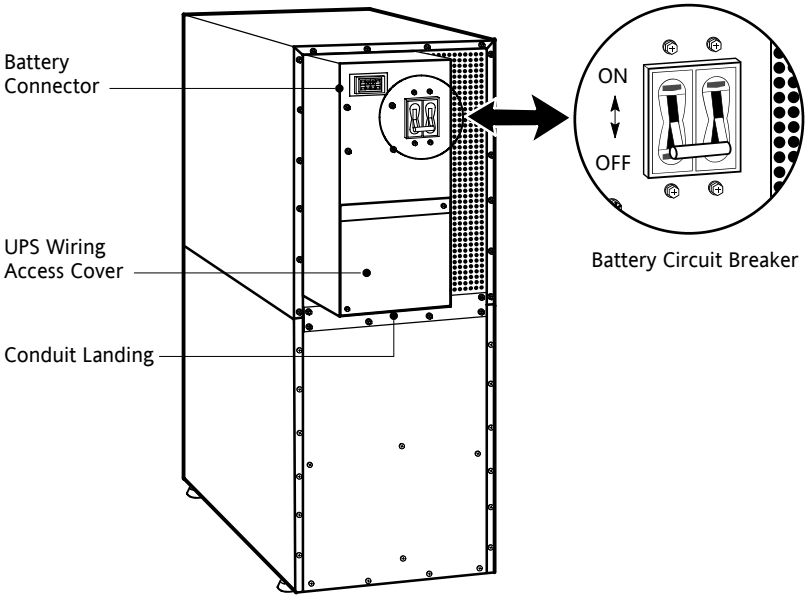

Figure 24. UPS Rear View

7. Install the conduit to the bypass switch cabinet. AC input and AC output conductors must be run through separate conduit. UPS output circuits must be installed in a dedicated conduit system and not shared with other electrical circuits.

8. Hardwire the terminal strip inside the bypass switch cabinet. Use copper wire that is the appropriate size for the current draw.

   See Figure 25 for a detailed view of the terminal strip label.

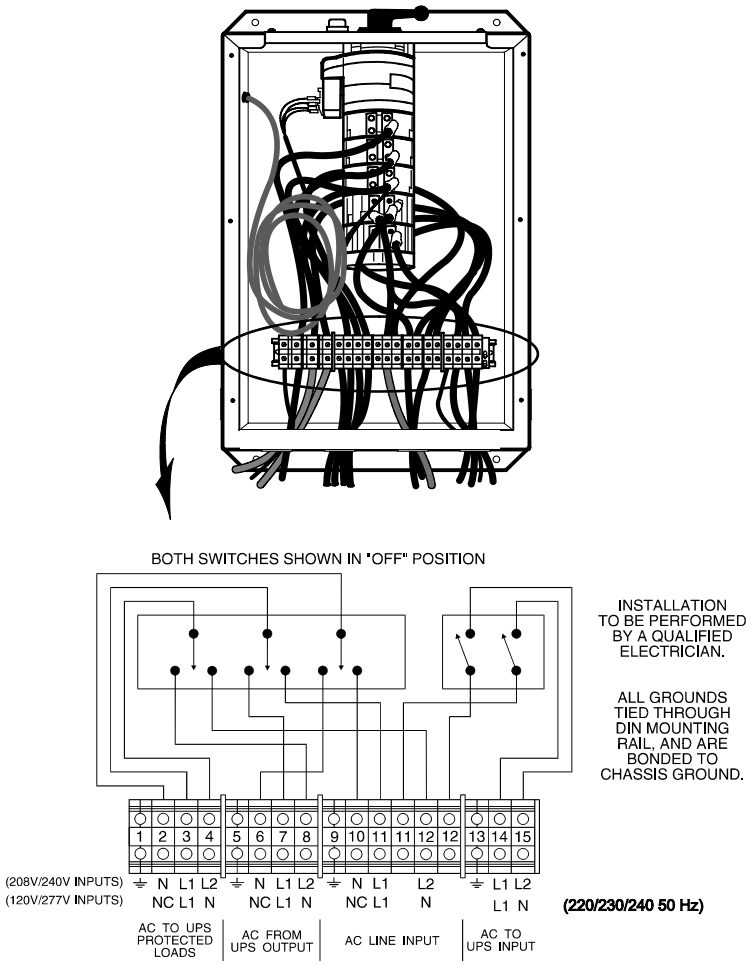
BOTH SWITCHES SHOWN IN "OFF" POSITION
INSTALLATION TO BE PERFORMED BY A QUALIFIED ELECTRICIAN.
ALL GROUNDS TIED THROUGH DIN MOUNTING RAIL, AND ARE BONDED TO CHASSIS GROUND.
1 2 3 4 5 6 7 8 9 10 11 11 12 12 13 14 15
(208V/240V INPUTS) N L1 L2 N L1 L2 N L1 L1 L2 L1 L2
(120V/277V INPUTS) NC L1 N NC L1 N NC L1 N L1 N
(220/230/240 50 Hz)
AC TO UPS PROTECTED LOADS
AC FROM UPS OUTPUT
AC LINE INPUT
AC TO UPS INPUT

Figure 25. Wall-Mounted Bypass Switch Terminal Strip Wiring

9. Connect the wiring from the bypass switch to the UPS terminal block.

See Table 9 for specifications and Figure 26 for a detailed view of the UPS terminal block.

Table 9. UPS Terminal Block Wiring

Wire Function		Terminal Position	Minimum Wire Size*	Tightening Torque	Conduit Connection (Entry Size)
Input	Ground	TB1-1	8 AWG	25 lb in (2.83 Nm)	2″ access hole for 1-1/2″ conduit
	L1	TB1-3	3 AWG		
	Neutral	TB1-4	3 AWG		
	L2	TB1-5	3 AWG		
Output	L1	TB1-6	3 AWG	25 lb in (2.83 Nm)	2″ access hole for 1-1/2″ conduit
	Neutral	TB1-7	3 AWG		
	L2	TB1-8	3 AWG		
	Ground	TB1-9	8 AWG		

*Use only 90°C-rated copper wire. Minimum wire size is based on 120/208 full load ratings applied to NEC Code Table 310-16.

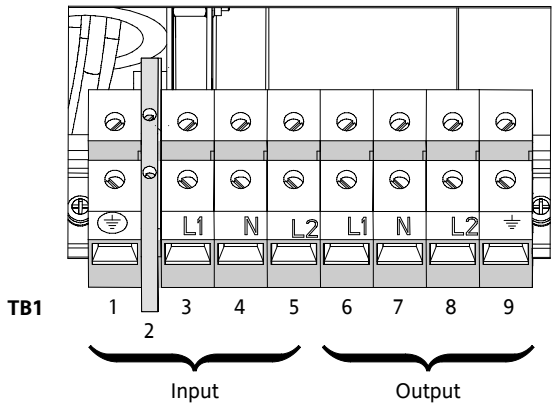

Figure 26. UPS Terminal Block

10. Route the gray signal cable through the grommet on the left side of the bypass switch cabinet (see Figure 27). Connect the white and black pair of wires to TB1-2 (the A/B maintenance bypass auxiliary contacts) on the UPS terminal block.

Secure each connection, tightening the terminal screws to a maximum 3.5 in lb (0.4 Nm). Provide strain relief for cables by installing plastic cable ties.

NOTE *DO NOT connect the red and black pair of wires in the gray signal cable.*

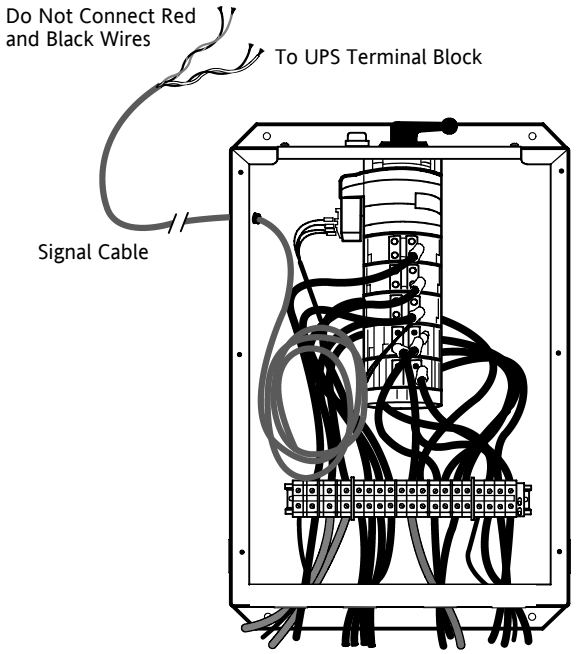

Figure 27. Signal Cable Installation

11. Replace the bypass switch front cover and the UPS wiring access cover.

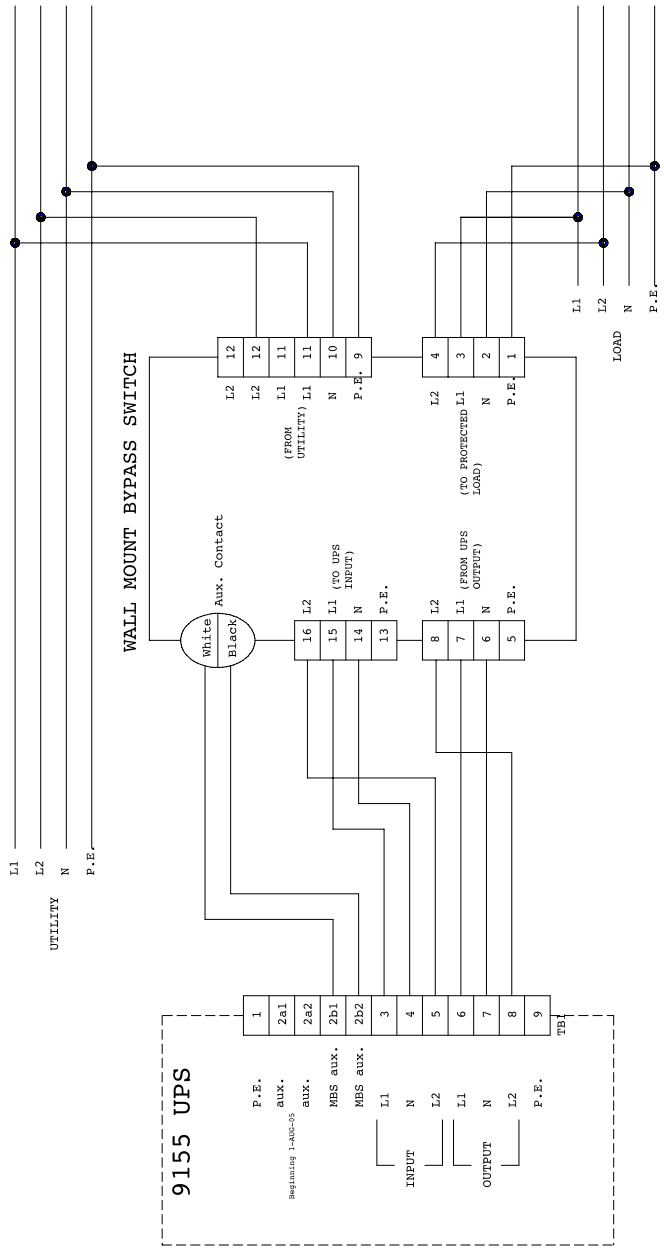

Figure 28. UPS with Wall-Mounted Bypass Switch Wiring Diagram

Chapter 8 Stabilizing the Cabinet

NOTE *For seismic installations, you MUST order and install a Powerware 9155 UPS seismic installation kit; do not use the following instructions.*

NOTE *For non-seismic installations, the stabilizing bracket MUST be installed on all 3-high cabinets. The stabilizing bracket is optional for 2-high cabinets.*

1. Lower the leveling feet to prevent the cabinet from rolling.

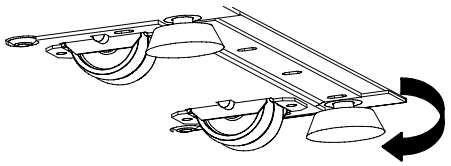

Figure 29. Lowering the Leveling Feet

2. Attach the stabilizing bracket to the bottom of the cabinet rear panel using the retained hardware from the shipping pallet (see Figure 30).

   Use the holes and slots in the bottom of the bracket to attach the cabinet to the flooring if desired.

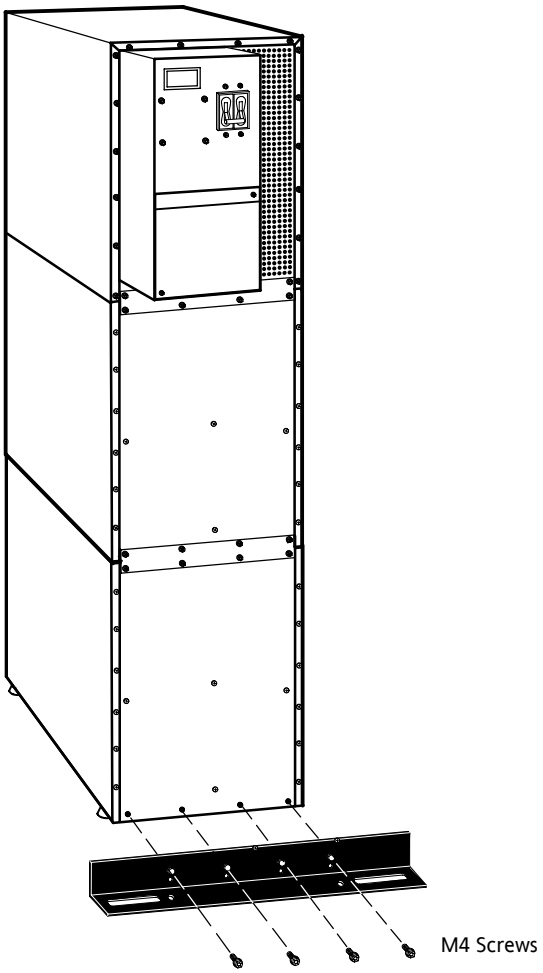

Figure 30. Installing the Stabilizing Bracket

3. Continue to one of the following sections:

- "Extended Battery Module Installation" on page 51 to install optional EBMs.
- "Communication" on page 53 to install UPS communication options, such as X-Slot cards or Remote Emergency Power-off.
- "Operation" on page 65 to start up the UPS.

Chapter 9 Extended Battery Module Installation

NOTE *A maximum of 22 battery strings can be installed in one configuration, including UPS batteries (4 EBM-64 models or 3 EBM-96 models). UPS-32 models contain 2 strings; UPS-64 models contain 4 strings; EBM-64 models contain 4 strings; and EBM-96 models contain 6 strings.*

NOTE *For non-seismic installations, the stabilizing bracket MUST be installed on all 3-high cabinets. The stabilizing bracket is optional for 2-high cabinets.*

NOTE *In a parallel system, each UPS should have the same number of EBMs to ensure equivalent runtimes.*

If you are installing an optional EBM(s), use the following steps:

1. **For cabinets using a stabilizing bracket:** Position the EBM at least 8″ (20.3 cm) away from the adjacent cabinet to allow space for the stabilizing bracket.
2. Verify that all battery circuit breakers are in the OFF position (see Figure 31).
3. Install the supplied ground strap (both ends attached to the EBM rear panel) between the UPS and the EBM:

   Disconnect the end of the ground strap farthest from the adjacent cabinet and retain the screw. Remove the screw from the adjacent cabinet's connecting plate. Attach the loose end of the ground strap to the adjacent cabinet.
4. If additional EBMs are installed, attach another ground strap between the first and second EBM. Repeat for each additional EBM.
5. Reinstall the remaining screw in the open hole where the ground strap was attached to the last EBM.
6. Plug the EBM cable into the UPS battery connector.

7. If additional EBMs are installed, plug the EBM cable of the second cabinet into the battery connector on the first EBM. Repeat for each additional EBM.

8. Attach a stabilizing bracket to each EBM if needed (see "Stabilizing the Cabinet" on page 49).

9. Continue to one of the following sections:

   - "Communication" on page 53 to install UPS communication options, such as X-Slot cards or REPO.
   - "Operation" on page 65 to start up the UPS.

NOTE *After UPS startup, ensure maximum battery runtime by configuring the UPS for the correct number of EBMs (see page 75).*

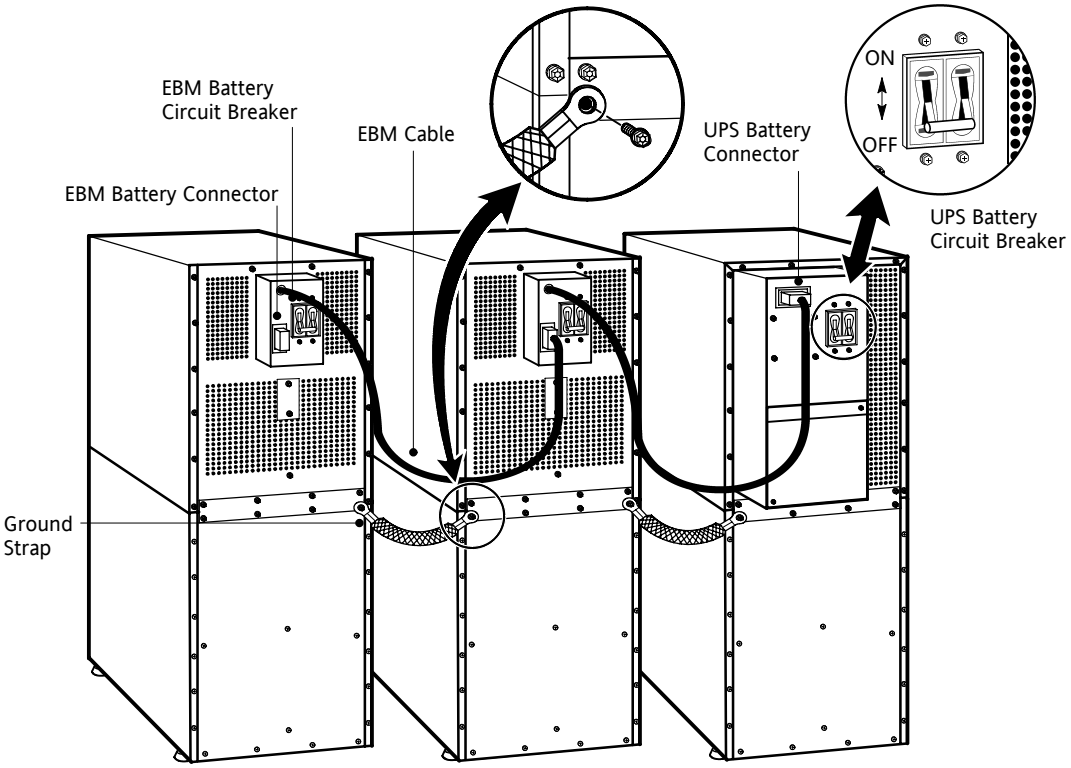

Figure 31. Typical EBM Installation (2-High Cabinets Shown)

Chapter 10 | Communication

This section describes the:

- DB-9 communication port
- X-Slot cards
- LanSafe Power Management Software
- Remote Emergency Power-off
- Relay output contacts
- Programmable signal inputs

Figure 32 shows the location of the communication options and control terminals on the UPS.

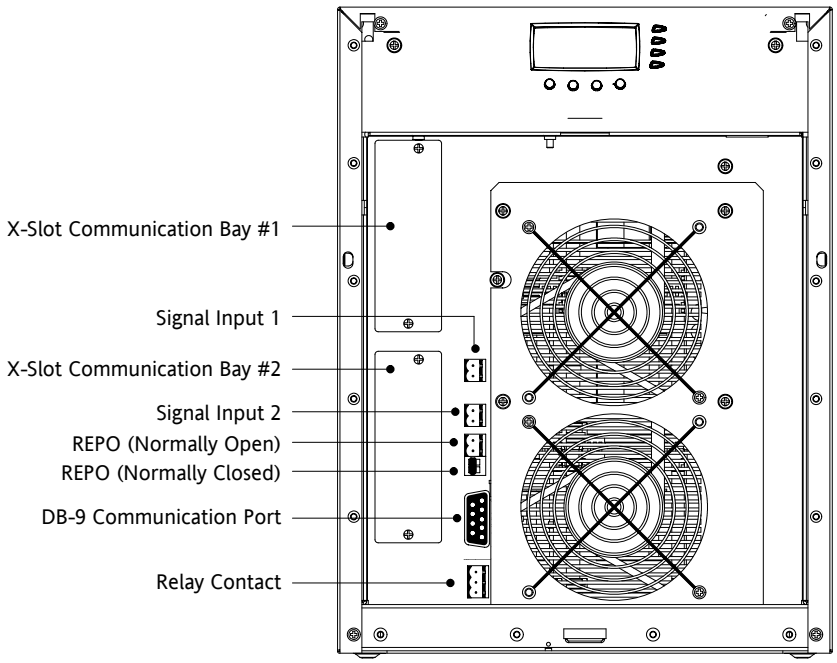

Figure 32. Communication Options and Control Terminals

Installing Communication Options and Control Terminals

To access and install the communication options and control terminals:

1. Remove the front covers of all cabinets, starting with the top cabinet. Press and release the handle latch at the bottom of each cover and then lift the cover up and off the cabinet (see Figure 33).

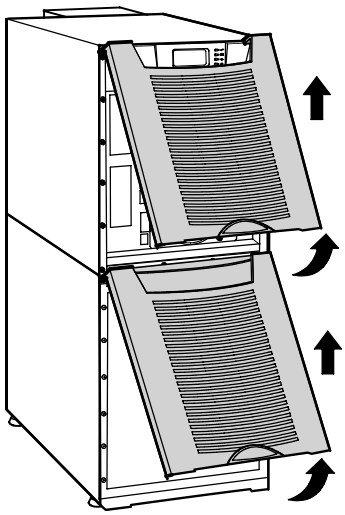

Figure 33. Removing the Front Covers

2. Install the appropriate X-Slot card and/or necessary cable(s) into the top cabinet (see Figure 32 and Figure 34).

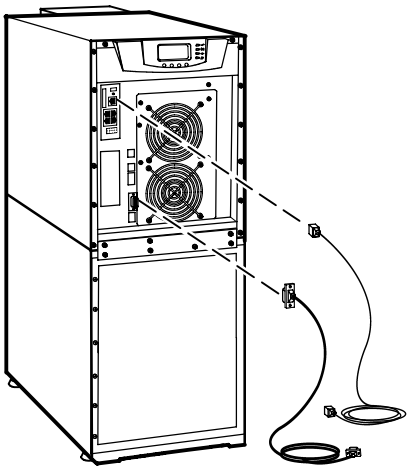

Figure 34. Installing Communication Cables

3. On the bottom cover (and also the middle cover if 3-high), remove a knockout tab in the top edge of the cover for each cable:

With wire cutters, cut either side of the tab and twist down to remove the tab (see Figure 35).

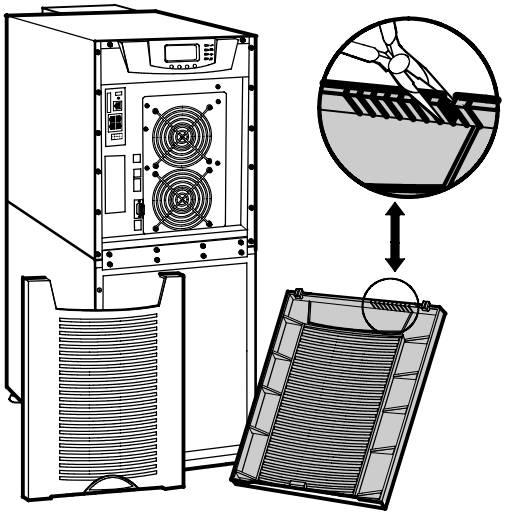

Figure 35. Removing Knockout Tabs

4. Route the cable(s) to the approximate location of the cover access holes.

5. Connect the cables to the appropriate location.

   See “Communication Options” on page 57 or “Control Terminals” on page 61 for detailed information.

6. Reinstall the front covers, starting with the bottom cabinet (see Figure 36).

   Hang the top edge of the cover on the cabinet first, then lower the bottom edge and snap into place. Be sure the cables fit in the access holes in the covers.

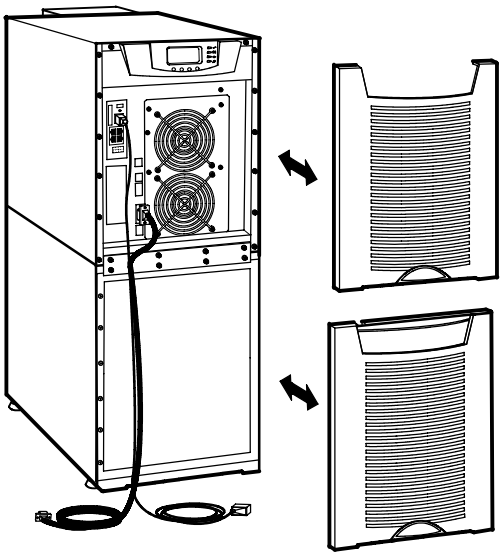

Figure 36. Reinstalling the Front Covers

7. Continue to “Operation” on page 65 to start up the UPS.

Communication Options

The Powerware 9155 has serial communication capabilities through the DB-9 communication port or through an X-Slot card in one of the available bays. In addition, the LanSafe Power Management Software can be installed and used to communicate with the UPS via one of the serial communication connections.

The UPS supports two serial communication devices according to the following table:

Independent	Multiplexed	
X-Slot 1	X-Slot 2	DB-9 Communication Port
Any X-Slot card	Any X-Slot card	Not in use
Any X-Slot card	Powerware Relay Interface Card Powerware Hot Sync CAN Card	Available
Any X-Slot card	Not in use	Available

NOTE *You can configure relays, signal inputs, and the serial port baud rate through the front panel menus (see Table 13 on page 68).*

DB-9 Communication Port

To establish communication between the UPS and a computer, connect your computer to the UPS communication port using the supplied communication cable.

When the communication cable is installed, power management software can exchange data with the UPS. The software polls the UPS for detailed information on the status of the power environment. If a power emergency occurs, the software initiates the saving of all data and an orderly shutdown of the equipment.

The cable pins are identified in Figure 37 and the pin functions are described in Table 10. See Figure 32 on page 53 for serial port location.

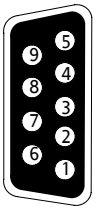

Figure 37. Communication Port

Table 10. Communication Port Pin Assignment

Pin Number	Signal Name	Function	Direction from the UPS
2	TxD	Transmit to external device	Out
3	RxD	Receive from external device	In
5	GND	Signal common (tied to chassis)	—

X-Slot Cards

X-Slot cards allow the UPS to communicate in a variety of networking environments and with different types of devices. The Powerware 9155 has two available communication bays for any X-Slot card, including:

- ConnectUPS™-X Web/SNMP Card - has SNMP and HTTP capabilities as well as monitoring through a Web browser interface; connects to a twisted-pair Ethernet (10/100BaseT) network. It has a built-in switching hub that allows three additional network devices to be connected to the network without the requirement of additional network drops. In addition, a Powerware Environmental Monitoring Probe can be attached to obtain humidity, temperature, smoke alarm, and security information.
- Relay Interface Card - has isolated dry contact (Form-C) relay outputs for UPS status: Utility failure, Low battery, UPS alarm/OK, or On bypass.
- Modbus® Card - allows you to continuously and reliably monitor the UPSs in your Building Management System (BMS).

- Industrial Relay Card (IRC) - is used to indicate the operating status of the UPS system using the customer's monitoring equipment. The IRC uses four isolated normally-open or normally-closed dry relay contacts to indicate the UPS status. Normal, Bypass, Battery, and Alarm mode can be monitored.
- Multi-Server Card - has six serial communication ports that can communicate simultaneously with other computers using LanSafe Power Management Software (provided on the Powerware Software Suite CD).
- Modem Card - provides out-of-band remote notification and monitoring using modem communication directly to cell phones and pagers.
- Single-Port Card - connects to the Powerware Expansion Chassis to enable multiple communication options or to a PC for power management control.
- ConnectUPS-MX SNMP Card - has Ethernet, modem, and SNMP capabilities.
- USB Card - connects to a USB port on your computer.

See Figure 32 on page 53 for the location of the two X-Slot communication bays.

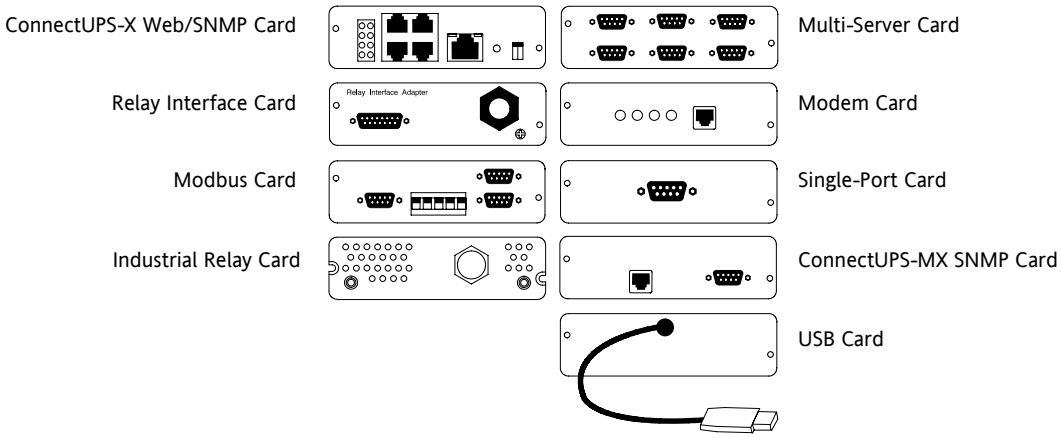

Figure 38. Optional X-Slot Cards

LanSafe Power Management Software

Each Powerware 9155 UPS ships with LanSafe Power Management Software and an interface cable. To begin installing LanSafe software, see the instructions accompanying the Powerware Software Suite CD.

NOTE *Use only the supplied communication cable to connect the UPS to your computer.*

LanSafe software provides up-to-date graphics of UPS power and system data and power flow. It also gives you a complete record of critical power events, and it notifies you of important UPS or power information. If there is a power outage and the Powerware 9155 UPS battery power becomes low, LanSafe software can automatically shut down your computer system to protect your data before the UPS shutdown occurs.

Control Terminals

The cables should be connected to the control terminals with cable clips. Input and output terminals have a functional isolation from terminal to terminal. They are connected to the UPS chassis through individual 1 MΩ resistors.

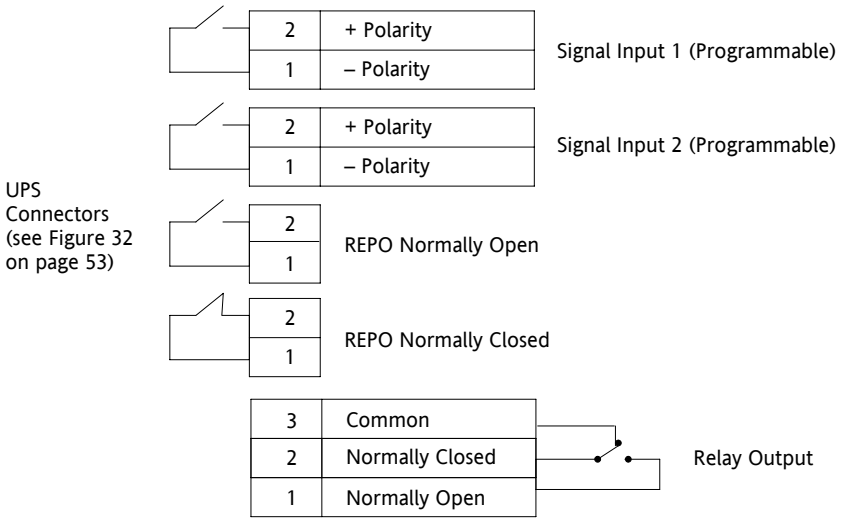

Figure 39. External Control Terminal Connections

NOTE *If using a semiconductor switch type, pay attention to the proper polarity. A relay or other mechanical control is preferred.*

Remote Emergency Power-off

REPO is used to shut down the UPS from a distance. This feature can be used for shutting down the load and the UPS by thermal relay, for instance in the event of room overtemperature. When REPO is activated, the UPS shuts down all converters, de-energizes all system relays, and fully powers down within 10-15 seconds.

There are two REPO positions that may be used, normally-open or normally-closed.

The pins on the normally-closed REPO connector are connected together. When this connection is open, the logic circuitry completely shuts down the UPS, thus preventing the power from supplying the load.

If the use of normally-closed REPO operation is desired, replace the connector with a normally-closed external switch (see Figure 32 on page 53).

If the use of normally-open REPO operation is desired, connect a normally-open external switch (see Figure 32 on page 53).

NOTE *To restart the UPS, reconnect the REPO connector pins and turn on the UPS manually. The pins must be shorted to keep the UPS running. Maximum resistance is 10 ohm.*

NOTE *Leave the REPO connector installed in the REPO port on the UPS rear panel even if the REPO function is not needed.*

CAUTION

The REPO must not be connected to any utility connected circuits. Reinforced insulation to the utility is required. The REPO switch must have a minimum rating of 24 Vdc and 20 mA.

To ensure the UPS stops supplying power to the load during any mode of operation, the input power must be disconnected from the UPS when the emergency power-off function is activated.

REPO Connections			
Wire Function		Terminal Wire Size Rating	Suggested Wire Size
REPO	L1 L2	12–22 AWG (4–0.32 mm^2)	18 AWG (0.82 mm^2)

Relay Contacts

The UPS incorporates a programmable relay output with potential free contacts for remote alarm indications (see Figure 32 on page 53). An additional four relay outputs can be obtained with the X-Slot compatible Relay Interface Card.

WARNING

The relay contacts must not be connected to any utility connected circuits. Reinforced insulation to the utility is required. The relay contacts must have a maximum rating of 30 Vdc/1A and 60 Vdc/2A nominal values.

Programmable Signal Inputs

The UPS incorporates two programmable signal inputs (see Figure 32 on page 53). Use of non-polar (relay) control input is recommended. The pins must be shorted with maximum resistance of 10 ohm in order to activate the specific input.

NOTE *See Figure 39 on page 61 for the polarity and verify these connections if polarity control is required.*

The default and programmable settings for the signal inputs are shown in Table 11.

Table 11. Programmable Signal Inputs

Signal	Description
Disable Bypass Operation	If active, the automatic transfer to the static bypass is prevented.
Charger Off	If active, the battery charge function is disabled. In a utility power outage, the discharge of batteries is supported.
Remote ON/OFF	If active, the UPS output turns off regardless of the mode of operation. Auxiliary power, fan, communication, and rectifier/battery charger remain functional. Restart is initiated immediately when this signal is inactive.
Request Bypass	If active, the UPS transfers to bypass if the bypass voltage, frequency, and synchronization are all okay.
Request Normal	If active, the UPS transfers to inverter operation if not prohibited by REPO or an alarm condition.
Force Bypass	If active, the UPS is forced to static bypass operation regardless of the bypass status.
External Battery Breaker Status	If active, the UPS knows that the batteries are disconnected.
Building Alarm 1–6	These alarms can be activated separately or at the same time with other building alarms.
Not in Use	Default
Shutdown	If active, the UPS shuts down immediately.
Delayed Shutdown	If active, the UPS shuts down after a user-configured delay time. Default shutdown delay is 120 seconds. The UPS automatically restarts when the signal changes to inactive.
Normal/Bypass	If active, the UPS transfers to bypass if okay. If inactive, the UPS transfers to the inverter when possible.
On Generator	If active, the UPS knows that input is fed from the generator. Bypass is disabled; the automatic battery test is disabled.
External Transformer Overtemperature	This option is not used.

Chapter 11 | Operation

This chapter contains information on how to use the Powerware 9155, including front panel operation, UPS startup and shutdown, and operation of the Maintenance Bypass switch.

Control Panel Functions

The UPS has a four-button graphical LCD with backlight. It provides useful information about the UPS itself, load status, events, measurements, and settings (see Figure 40).

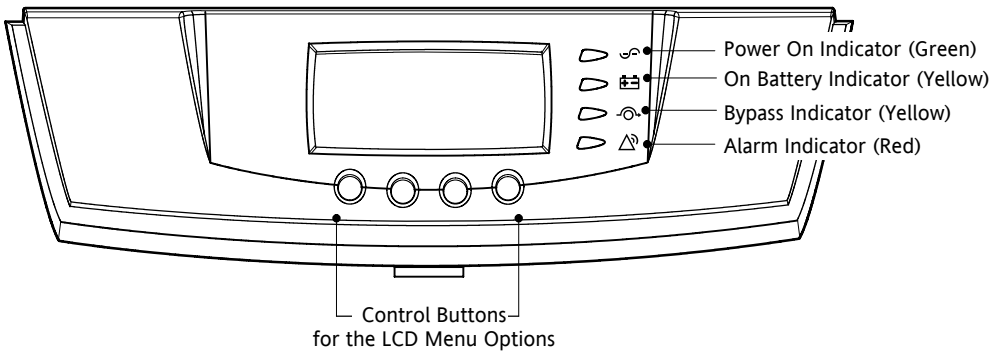

Figure 40. Powerware 9155 Control Panel

The following table shows the indicator status and description.

Indicator	Status	Description
Green	On	The UPS is operating normally.
	Flashing	• The UPS is starting up or is shut down and waiting for power to return. • A new information message is active. • Bypass is not available.
	Off	The UPS is turned off and will not turn on automatically.
Yellow	On	The UPS is in Battery mode.
Yellow	On	The UPS is in Bypass mode.
Red	On	The UPS has an active alarm.
	Flashing	There is a new UPS alarm condition. See “Troubleshooting” on page 91 for additional information.

Changing the Language

Press and hold the first button on the left for approximately five seconds to select the language menu. This action is possible from any LCD menu screen.

Display Functions

As the default or after 15 minutes of inactivity, the LCD displays the selectable startup screen. The default is the Eaton Powerware logo and can be changed to the Mimic screen in the User Settings menu.

The backlit LCD automatically dims after a long period of inactivity. Press any button to restore the screen.

Use the two middle buttons (↑ and ↓) to scroll through the menu structure. Press the → button to enter a submenu. Press the ↵ button to select an option. Press the ESC button to cancel or return to the previous menu.

The following table shows the basic menu structure.

Table 12. Menu Map for Display Functions

Main Menu	Submenu	Display Information or Menu Function
UPS Status		UPS off / System normal / UPS supporting load / UPS on battery / UPS on bypass / Active alarm list / Battery status
Event Log		Displays up to 100 events and alarms
Measurements	Output	L-N and L-L / Current / Frequency / Power
	Battery	Voltage / Current / Runtime
	Input	L-N and L-L / Current / Frequency
	Bypass	L-N and L-L / Frequency
Control	Go to Bypass Mode	Forces the UPS to go to Bypass When this command is active, the option changes to Go to Normal Mode.
	Start Battery Test	Initiates a battery test
	Display Test	Four different selectable tests for the front panel functions: the LEDs cycle through, the alarm beep sounds, the backlight turns off and on, and the pixels scroll through to test the LCD.
Settings	User Settings	See Table 13 for detail.
	Service Settings	This screen is password-protected.
Identification		UPS Type / Part Number / Serial Number / Firmware / Display / CAN Bridge
Turn UPS ON/OFF	ON and OFF Options	

User Settings

The following table displays the options that can be changed by the user.

NOTE *Changes to the output voltage or frequency options should be made before turning on the UPS; otherwise, the changes do not take effect.*

Table 13. User Settings

Description	Available Settings	Default Setting
Set Date and Time	Set Month Date: mm/dd/yyyy Time: 24:00	 01/01/2003 00:00
Display Contrast	Adjust contrast with up/down arrow buttons	Moderate
Change Language	Select Language: <English> or <Spanish>	English
Relay Config	Relay: [Alarm 1] [X-Slot 1-1/2/3/4] or [X-Slot 2-1/2/3/4] Setup: [Battery Low] [On Battery] [On Bypass] [UPS ok] [custom] [empty]	Alarm 1: UPS ok X-Slots (1 or 2) #1: On Battery #2: Battery Low #3: UPS ok #4: On Bypass
Signal Inputs	[empty] [Logic] (see “Programmable Signal Inputs” on page 63)	Empty
Serial Port Config	Port: [X-Slot-1] [X-Slot-2/Serv] Speed: [19200] [9600] [2400] [1200]	19200
Parallel Operation Settings	Refer to the *Powerware 9155 Parallel UPS (8–15 kVA) User’s Guide*.	
Start Screen	Eaton Powerware logo Mimic Screen	Eaton Powerware logo
User Password	Enabled/Disabled If Enabled is selected, the password is USER.	Disabled
Audible Alarms	Normal Sound/Disabled	Normal Sound
Battery Charging	ABM cycling/constant	ABM cycling

Table 13. User Settings (continued)

Description	Available Settings	Default Setting
Automatic Battery Tests	Enabled/Disabled Enabled automatically runs the battery test once a month.	Enabled
Number of Battery Strings	0 through 22 (see "Configuring the UPS for EBMs" on page 75)	2 strings for UPS-32 models 4 strings for UPS-64 models
Battery Capacity	1 through 65535 watts per cell	34 W/cell
Battery Low Alarm Level	1.750 through 1.950 volts per cell	1.880 V/cell
Set Nominal Output Voltage	120V/240V 120V/208V 110V/220V 100V/200V 127V/220V	120V/208V
Bypass Voltage High Limit	+1 through +20% (1% increments)	120V +10%
Bypass Voltage Low Limit	-1 through -20% (1% increments)	120V -15%
Nominal Output Frequency	50 Hz or 60 Hz	60 Hz
Synchronization	Enabled/Disabled	Enabled
Synchronization Window	±0.5 through ±3.0 Hz (0.1 Hz increments)	±2.0 Hz
Unsynchronized Transfer to Bypass	Allowed/Not Allowed	Not Allowed
Usage of Bypass	Enabled/Disabled	Enabled
Transfer to Bypass When Overload	After a delay/Immediately	After a delay
Automatic Start Delay	-1 through 32767 seconds (-1 means disabled)	0s
Automatic On Battery Shutdown Delay	-1 through 32767 seconds (-1 means disabled)	-1s
Control Commands from X-Slot1	Allowed/Disabled	Allowed
Control Commands from X-Slot2/Serv	Allowed/Disabled	Allowed
X-Slot Signal Input Activation Delay	0 through 65 seconds	5s
Input signal delayed shutdown delay	1 through 65535 seconds	120s

Table 13. User Settings (continued)

Description	Available Settings	Default Setting
Site Wiring Fault Notice	Enabled/Disabled	Enabled
Reset Custom Event Settings	0 through 32	Empty
Full Power Battery Test	Enabled/Disabled	Enabled
Auto Output Configuration	Enabled/Disabled	Enabled for initial startup Disabled after initial startup

UPS Startup

WARNING

Only qualified service personnel (such as a licensed electrician) should perform the UPS installation and initial startup. Risk of electrical shock.

Verify that UPS installation has been carried out correctly and the UPS ground has been connected.

Maintenance Bypass Startup

If you have an optional Maintenance Bypass Module or Power Distribution Module, you can start up the UPS in maintenance bypass, allowing utility power to supply the load.

To start up the UPS in maintenance bypass:

1. Verify that the Maintenance Bypass switch is in the BYPASS position (see Figure 41 on page 79).
2. Switch on utility power where the UPS is connected. The load is now powered by utility power.

To switch to Normal mode from maintenance bypass:

1. If an optional isolation transformer is installed, switch the input circuit breaker to the ON position.

NOTE *The isolation transformer output is always 240V (180° phase angle). Any equipment connected to the output requiring 208V (120° phase angle) is at risk for damage.*

2. Turn the Maintenance Bypass switch to the SERVICE position.

   The UPS starts up in Bypass mode, with the load still powered by utility power.

3. Remove the breaker tie from all battery circuit breakers.

4. Switch all battery circuit breakers to the ON position.

NOTE *Wait until the indicator illuminates before proceeding to Step 5; otherwise, power to the load may be lost.*

5. Turn the Maintenance Bypass switch to the UPS position to return to Normal mode. The UPS is now powering the load.

Internal Bypass Startup

To start up the UPS in Bypass mode without an MBM/PDM:

1. If an optional isolation transformer is installed, switch the input circuit breaker to the ON position.

NOTE *When using the optional isolation transformer, Bypass mode is available only for 240V phase-phase (180° phase angle).*

2. Switch on utility power where the UPS is connected.

3. Wait for the front panel LCD to illuminate.

   The indicator flashes.

4. Remove the breaker tie from all battery circuit breakers.

5. Switch all battery circuit breakers to the ON position.

   The ⚠ indicator stops flashing.

6. Press any button on the front panel display to activate the menu options.

7. Using the ↑ button on the front panel display, scroll to the Control menu option and press the → button.

8. Press the ↵ button to select the Go to Bypass Mode option.

   The ⟲ and ⟳ indicators illuminate, indicating the UPS is operating in Bypass mode. The load is now powered by utility power.

To switch to Normal mode from internal Bypass mode:

1. Press the ↵ button to select the Go To Normal Mode option.

2. Press the ESC button until the Eaton Powerware logo appears.

Normal Mode Startup

To start up the UPS:

1. If you have an optional MBM/PDM, verify that the Maintenance Bypass switch is in the UPS position (see Figure 41 on page 79).

2. If an optional isolation transformer is installed, switch the input circuit breaker to the ON position.

3. Switch on utility power where the UPS is connected.

4. Wait for the front panel LCD to illuminate.

   The ⚠ indicator flashes.

5. Remove the breaker tie from all battery circuit breakers.

6. Switch all battery circuit breakers to the ON position.

   The ⚠ indicator stops flashing.

7. Press any button on the front panel display to activate the menu options.

8. Press the ↑ button on the front panel display and then press the → button to select the TURN UPS ON/OFF menu.

9. Select the ON option. Press and hold the ↵ button for three seconds, until the UPS stops beeping.

   The ⏻ indicator illuminates. The UPS is now powering the load.

   If the ⚠ indicator is flashing, check the UPS status from the front panel to view the active alarms. Correct the alarms and restart if necessary.

Starting the UPS on Battery

NOTE *Before using this feature, the UPS must have been powered by utility power at least once.*

To start the UPS on battery:

1. If you have an optional MBM/PDM, verify that the Maintenance Bypass switch is in the UPS position (see Figure 41 on page 79).
2. Switch all battery circuit breakers to the ON position.

NOTE *Leave the battery circuit breaker(s) in the ON position during this operation. If you need to cancel this operation, wait until the front panel LCD illuminates before switching the battery circuit breaker(s) off.*

3. Wait for the front panel LCD to illuminate.
4. Press any button on the front panel display to activate the menu options.
5. Within three minutes, press the ↑ button on the front panel display and then press the → button to select the TURN UPS ON/OFF menu.
6. Select the ON option. Press and hold the ↵ button for three seconds, until the UPS stops beeping.

   The UPS starts within two minutes. The UPS supplies power to your equipment and goes into Battery mode.

Configuring the UPS for EBMs

To ensure maximum battery runtime, configure the UPS for the correct number of EBMs:

1. Press any button on the front panel display to activate the menu options.
2. Using the ↑ button, scroll to the Settings menu.
3. Press the → button twice to select the User Settings menu.
4. Using the ↓ button, scroll to the Number of Battery Strings option and press the → button.
5. Use the ↑ or ↓ arrow buttons to select the number of strings according to your UPS configuration:

All 2-High UPS and EBM Cabinets*	Number of Strings
UPS + 1 EBM	6
UPS + 2 EBMs	10
UPS + 3 EBMs	14
UPS + 4 EBMs	18
All 3-High UPS and EBM Cabinets*	**Number of Strings**
UPS + 1 EBM	10
UPS + 2 EBMs	16
UPS + 3 EBMs	22

*UPS-32 models contain 2 strings; EBM-64 models contain 4 strings. UPS-64 models contain 4 strings; EBM-96 models contain 6 strings.

6. Press the ↵ button to save the setting.
7. Press the ESC button until the Eaton Powerware logo appears.

UPS Shutdown

To shut down the UPS:

1. Press any button on the front panel display to activate the menu options.
2. Press the ↑ button on the front panel display and then press the → button to select the TURN UPS ON/OFF menu.
3. Select the OFF option; press the ↵ button.
4. Confirm the selection. Press and hold the ↵ button for three seconds, until the UPS stops beeping.

   The input contactor opens.
5. Switch the UPS battery circuit breaker to the OFF position.

   The UPS is disconnected from the batteries and is on logic power only.
6. Switch off utility power where the UPS is connected.

Chapter 12 | UPS Maintenance

This section explains how to:

- Care for the UPS and batteries
- Recycle used batteries
- Use the Maintenance Bypass switch

UPS and Battery Care

For the best preventive maintenance, keep the area around the UPS clean and dust-free. If the atmosphere is very dusty, clean the outside of the system with a vacuum cleaner.

For full battery life, keep the UPS at an ambient temperature of 77°F (25°C).

Storing the UPS and Batteries

When storing the UPS and optional cabinets, the following requirements should be met:

- Verify that the battery circuit breaker is in the OFF position.
- Avoid temperature and humidity extremes. To maximize battery life, the recommended storage temperature is 59°F (15°C) to 77°F (25°C).
- If you store the UPS for a long period, recharge the batteries every 10 months by applying utility power. The batteries charge to 80% capacity in approximately 3 hours. However, it is recommended that the batteries charge for 48 hours after long-term storage.
- Check the battery recharge date on the shipping carton label. If the date has expired and the batteries were never recharged, do not use the UPS. Contact your service representative.

When to Replace Batteries

When the ⚠ indicator flashes and the LCD panel displays Battery Failure, the batteries may need replacing. Contact your service representative to order new batteries.

Change the batteries approximately every five years.

Recycling the Used Battery

Contact your local recycling or hazardous waste center for information on proper disposal of the used battery.

WARNING

- Do not dispose of the battery or batteries in a fire. Batteries may explode. Proper disposal of batteries is required. Refer to your local codes for disposal requirements.
- Do not open or mutilate the battery or batteries. Released electrolyte is harmful to the skin and eyes. It may be toxic.

CAUTION

Do not discard the UPS or the UPS batteries in the trash. This product contains sealed, lead-acid batteries and must be disposed of properly. For more information, contact your local recycling/reuse or hazardous waste center.

CAUTION

Do not discard waste electrical or electronic equipment (WEEE) in the trash. For proper disposal, contact your local recycling/reuse or hazardous waste center.

Using the UPS-Mounted Maintenance Bypass Switch

The UPS-mounted Maintenance Bypass switch is part of the optional Maintenance Bypass Module or Power Distribution Module and is located on the back of the UPS (see Figure 41).

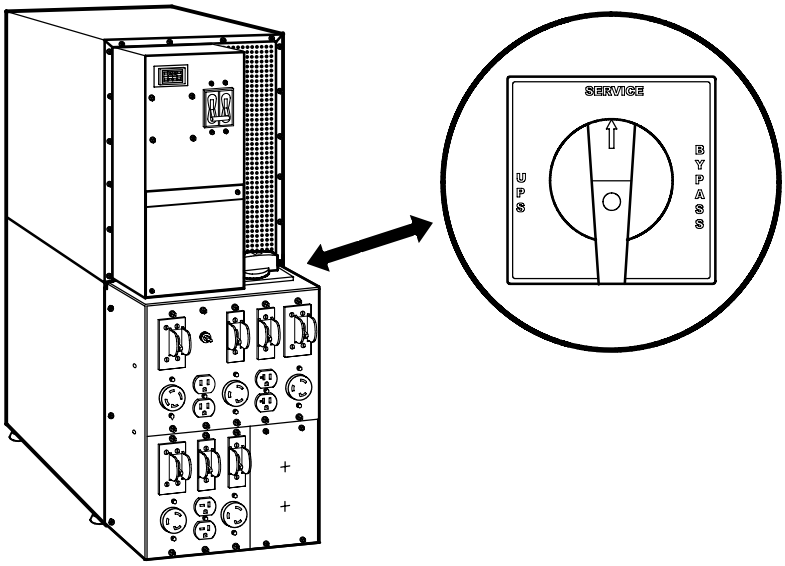

Figure 41. Maintenance Bypass Switch (PDM Shown)

The UPS-mounted bypass switch has three positions as described in Table 14.

NOTE *In the UPS or SERVICE position, AC input power is still connected to the input terminals inside the UPS.*

Table 14. UPS-Mounted Bypass Switch Positions

Switch Position	Description
UPS	Connects the UPS output to the load.
SERVICE	Connects the load directly to AC input power and disconnects UPS output. AC input power is still connected to the UPS input.
BYPASS	Like the SERVICE position, BYPASS connects the load directly to AC input power and disconnects UPS output. **However, because BYPASS also disconnects AC input from the UPS, this is the appropriate position for UPS maintenance or repair.**

Figure 42 shows a UPS with a separate battery cabinet and a UPS-mounted bypass switch.

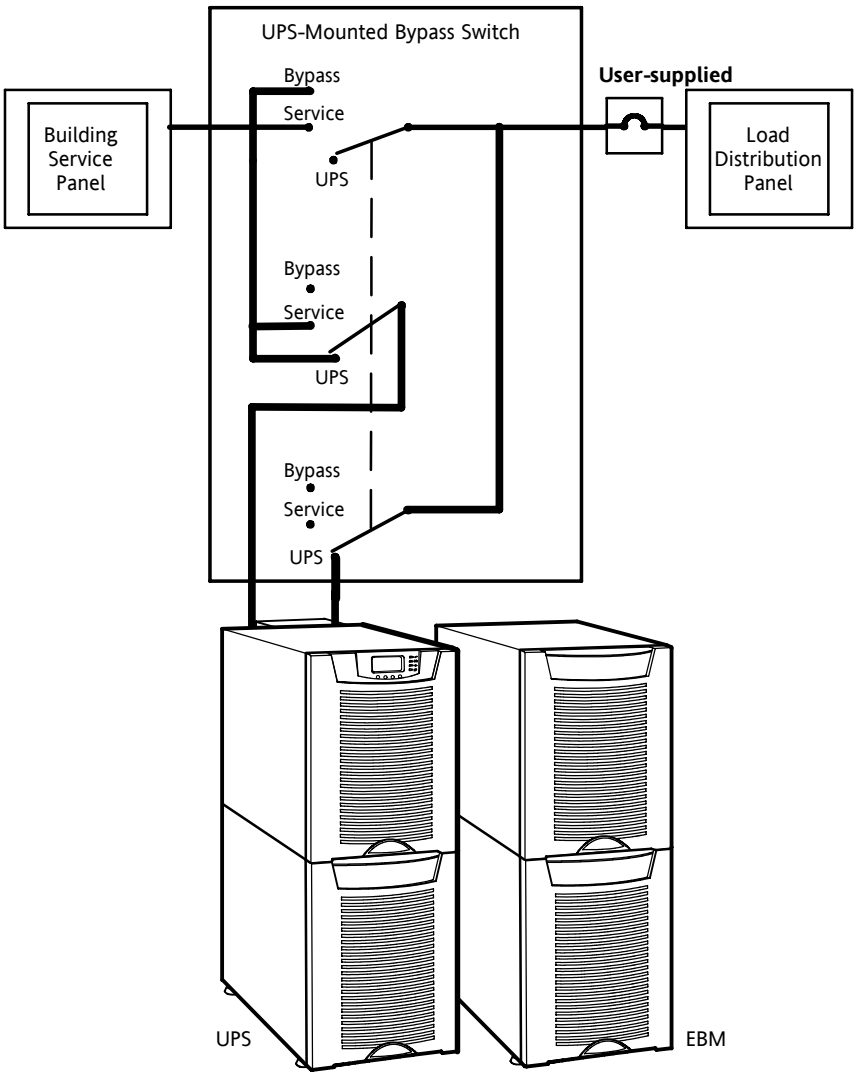

Figure 42. Typical Hardwired Installation with UPS-Mounted Bypass Switch

To switch the UPS to maintenance bypass from Normal mode (UPS-mounted operation):

1. Turn the Maintenance Bypass switch through the SERVICE position to the BYPASS position.

   The battery circuit breaker trips, and the UPS is now bypassed, with the load powered by utility power.

2. The UPS automatically shuts down.

To return to Normal mode from maintenance bypass (UPS-mounted operation):

1. If an optional isolation transformer is installed, switch the input circuit breaker to the ON position.

NOTE *The isolation transformer output is always 240V (180° phase angle). Any equipment connected to the output requiring 208V (120° phase angle) is at risk for damage.*

2. Turn the Maintenance Bypass switch to the SERVICE position.

   The UPS starts up in Bypass mode, with the load still powered by utility power.

3. Switch the UPS battery circuit breaker to the ON position.

NOTE *Wait until the* *indicator illuminates before proceeding to Step 4; otherwise, power to the load may be lost.*

4. Turn the Maintenance Bypass switch to the UPS position to return to Normal mode. The UPS is now powering the load.

Using the Wall-Mounted Bypass Switch

The wall-mounted bypass switch is rated at 80A/300 Vac and has four positions as described in Table 15.

NOTE *In the UPS or LINE position, AC input power is still connected to the input terminals inside the UPS.*

Table 15. Wall-Mounted Bypass Switch Positions

Switch Position	Description
UPS	Connects the UPS output to the load.
LINE	Connects the load directly to AC input power and disconnects UPS output. AC input power is still connected to the UPS input.
SERVICE	Like the LINE position, SERVICE connects the load directly to AC input power and disconnects UPS output. **However, because SERVICE also disconnects AC input from the UPS, this is the appropriate position for UPS maintenance or repair.**
OFF	Disconnects the load from the UPS output power and AC input power, as well as AC input power to the UPS input.

You must press the red button beside the switch before turning the Maintenance Bypass switch.

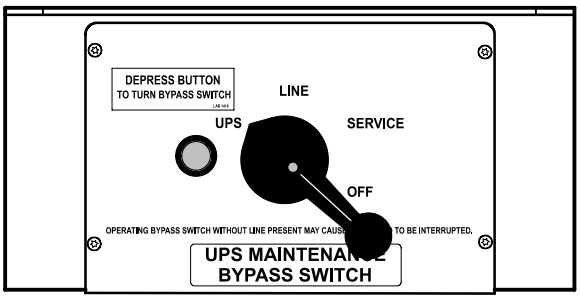

Figure 43. Wall-Mounted Maintenance Bypass Switch

Figure 44 shows a UPS with a separate battery cabinet and a wall-mounted bypass switch.

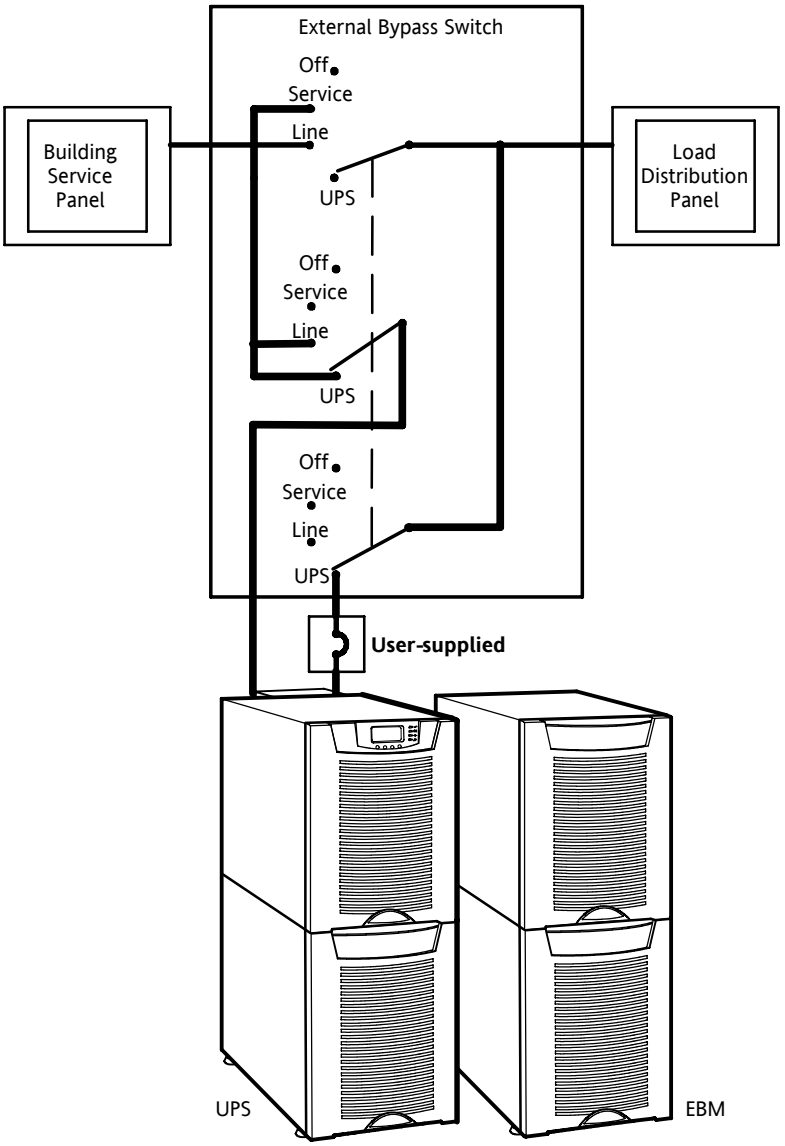

Figure 44. Typical Hardwired Installation with Wall-Mounted Bypass Switch

To switch the UPS to maintenance bypass from Normal mode (wall-mounted operation):

1. Press the red button beside the Maintenance Bypass switch.
2. Turn the switch handle through the LINE position to the SERVICE position.

   The battery circuit breaker trips, and the UPS is now bypassed, with the load powered by utility power.
3. The UPS automatically shuts down.

To return to Normal mode from maintenance bypass (wall-mounted operation):

1. If an optional isolation transformer is installed, switch the input circuit breaker to the ON position.
2. Turn the Maintenance Bypass switch to the LINE position.

   The UPS starts up in Bypass mode, with the load still powered by utility power.
3. Switch the UPS battery circuit breaker to the ON position.

NOTE *Wait until the indicator illuminates before proceeding to Step 4; otherwise, power to the load may be lost.*

4. Turn the Maintenance Bypass switch to the UPS position to return to Normal mode. The UPS is now powering the load.

Chapter 13 Specifications

This section provides the following specifications for the Powerware 9155 models:

- Model list
- Dimensions and weights
- Environmental and safety specifications
- Technical specifications
- Model specifications
- Battery specifications
- Battery runtimes

Table 16. Model List

UPS	Description	Power Rating
PW9155-8-32	2-high: UPS with one battery section 3-high: UPS with one battery & one input isolation transformer section	8 kVA, 7.2 kW
PW9155-8-64	3-high: UPS with two battery sections	8 kVA, 7.2 kW
PW9155-10-32	2-high: UPS with one battery section 3-high: UPS with one battery & one input isolation transformer section	10 kVA, 9 kW
PW9155-10-64	3-high: UPS with two battery sections	10 kVA, 9 kW
PW9155-12-32	2-high: UPS with one battery section 3-high: UPS with one battery & one input isolation transformer section	12 kVA, 10.8 kW
PW9155-12-64	3-high: UPS with two battery sections	12 kVA, 10.8 kW
PW9155-15-32	2-high: UPS with one battery section 3-high: UPS with one battery & one input isolation transformer section	15 kVA, 13.5 kW
PW9155-15-64	3-high: UPS with two battery sections	15 kVA, 13.5 kW

EBM	Description
PW9155-EBM-64	2-high: two battery sections
PW9155-EBM-96	3-high: three battery sections

Table 17. Dimensions and Weights

	Dimensions (H x W x D)	Weight
2-High UPS	32.2″ × 12″ × 32″ (81 × 30 × 81 cm)	352 lb (160 kg)
3-High UPS-32	47.8″ × 12″ × 32″ (121.5 × 30 × 81 cm)	550 lb (250 kg)
3-High UPS-64	47.8″ × 12″ × 32″ (121.5 × 30 × 81 cm)	590 lb (268 kg)
2-High EBM	32.2″ × 12″ × 30.3″ (81 × 30 × 77 cm)	480 lb (218 kg)
3-High EBM	47.8″ × 12″ × 30.3″ (121.5 × 30 × 77 cm)	710 lb (322 kg)
PDM (rear UPS mount)	16.5″ × 12″ × 7″ (42 × 30 × 17.8 cm)	25 lb (11 kg)
MBM (rear UPS mount)	16.5″ × 12″ × 7″ (42 × 30 × 17.8 cm)	18 lb (8 kg)

Table 18. Environmental and Safety Specifications

Operating Temperature	10°C to 40°C (50°F to 104°F) Optimal battery performance: 25°C (77°F)
Transit Temperature	-25°C to 55°C (-13°F to 131°F)
Storage Temperature	0°C to 25°C (32°F to 77°F) Recommended battery storage: 59°F (15°C) to 77°F (25°C)
Ventilation	Front air intake, forced air, two fans, positive pressurization, temperature UPS-monitored
Altitude	9,843 ft (3,000m) operating without derating 32,810 ft (10,000m) during transportation
Relative Humidity	5–95% noncondensing
Heat Dissipation	5582 BTU/hr maximum online 5294 BTU/hr maximum on battery
Audible Noise	<56 dBA at 1 meter distance, typical loads <62 dBA for heavy load, high ambient or high altitude, on battery
Safety Conformance	NOM-019-SCFI, UL 1778, CSA C22.2, No. 107.3; EN 55022 Class A (CISPR22 Class A) and IEC 60950; IEC 62040-1-1
Agency Markings	UL, cUL, CE, NOM-NYCE
EMC (Class A)	IEC 62040-2, FCC Part 15, ICES-003, VCCI
Surges	IEEE/ANSI C62.41 Cat B3

Table 19. Technical Specifications

Technology	Online, double-conversion, split-phase topology with Static Bypass switch and optional 3-position Maintenance Bypass switch. Frequency independent operation.
Input Voltage Range	75–144 Vac per phase
Input Isolation Transformer Input Voltage Range	208V or 240V ±20%
Input Power Factor	>0.99 at full load nominal line conditions
Input Rated Voltage	100/200, 110/220, or 120/240 Vac with 180° phase displacement 120/208 or 127/220 Vac with 120° phase displacement
Input Frequency Range	45–65 Hz
Input Rated Frequency	50/60-Hz selectable, auto-configuring
Output Voltage Regulation	±1% static, Phase to Neutral ±2% static, Phase to Phase ±5% dynamic at 100% resistive load change Response time <1 ms
Output Voltage Distortion	<2% THD linear load <5% THD non-linear load
Output Frequency	50/60-Hz selectable or auto-configuring
Output Frequency Regulation	Synchronization to line
Output Frequency Conversion	Frequency/phase-converter operation with derated output load capacity to 80%; Frequency Conversion mode can be configured through the front panel or through XCP commands. Bypass is not available in Frequency Conversion mode.
Output Overload	101–110% for 10 minutes 111–125% for 60 seconds 126–149% for 5 seconds >150% for 300 milliseconds

Table 20. Model Specifications

	Model 15 kVA				
Output Voltage (line–line)	200	220	240	208	220
Output Voltage (line–neutral)	100	110	120	120	127
Input Current*	71A	71A	71A	71A	67A
Output Current	63A	63A	63A	63A	59A
Output kVA (line–line loads)	12.5	13.8	15.0	13.0	13.0
Output kVA (line–neutral loads)	12.5	13.8	15.0	15.0	15.0
Output kW	11.3	12.4	13.5	13.5	13.5
Output Peak Current	155	155	155	155	155
Efficiency (minimum)	88%	88%	88%	88%	88%
Power Dissipation (BTU/hr)	5582	5582	5582	5582	5582
DC Voltage (supply)	192	192	192	192	192
	Model 12 kVA				
Output Voltage (line–line)	200	220	240	208	220
Output Voltage (line–neutral)	100	110	120	120	127
Input Current*	68A	62A	57A	57A	54A
Output Current	60A	55A	50A	50A	47A
Output kVA (line–line loads)	12.0	12.0	12.0	10.4	10.4
Output kVA (line–neutral loads)	12.0	12.0	12.0	12.0	12.0
Output kW	10.8	10.8	10.8	10.8	10.8
Output Peak Current	132	132	132	132	132
Efficiency (minimum)	88%	88%	88%	88%	88%
Power Dissipation (BTU/hr)	4512	4512	4512	4512	4512
DC Voltage (supply)	192	192	192	192	192

*Input current for the input isolation transformer is 4% higher than for the UPS.

Table 20. Model Specifications (continued)

	Model 10 kVA				
Output Voltage (line–line)	200	220	240	208	220
Output Voltage (line–neutral)	100	110	120	120	127
Input Current*	57A	52A	48A	48A	45A
Output Current	50A	45A	42A	42A	39A
Output kVA (line–line loads)	10.0	10.0	10.0	8.7	8.7
Output kVA (line–neutral loads)	10.0	10.0	10.0	10.0	10.0
Output kW	9.0	9.0	9.0	9.0	9.0
Output Peak Current	110	110	110	110	110
Efficiency (minimum)	87%	87%	87%	87%	87%
Power Dissipation (BTU/hr)	4175	4175	4175	4175	4175
DC Voltage (supply)	192	192	192	192	192
	Model 8 kVA				
Output Voltage (line–line)	200	220	240	208	220
Output Voltage (line–neutral)	100	110	120	120	127
Input Current*	46A	42A	38A	38A	36A
Output Current	40A	36A	33A	33A	31A
Output kVA (line–line loads)	8.0	8.0	8.0	6.9	6.9
Output kVA (line–neutral loads)	8.0	8.0	8.0	8.0	8.0
Output kW	7.2	7.2	7.2	7.2	7.2
Output Peak Current	88	88	88	88	88
Efficiency (minimum)	87%	87%	87%	87%	87%
Power Dissipation (BTU/hr)	3300	3300	3300	3300	3300
DC Voltage (supply)	192	192	192	192	192

*Input current for the input isolation transformer is 4% higher than for the UPS.

Table 21. Battery Specifications

Battery Type	9 Ah sealed, valve-regulated lead acid (VRLA), maintenance-free, minimum 3-year float service life at 77°F (25°C), voltage 192 Vdc (96 cells per string)
Number of Strings	Maximum of 22 strings per full configuration, including UPS batteries (4 EBM-64 cabinets or 3 EBM-96 cabinets, plus UPS batteries) UPS-32: 2 strings; UPS-64: 4 strings EBM-64: 4 strings; EBM-96: 6 strings
Battery Replacement	Must be replaced by qualified service technician
Charger	Service configurable 0.5–34A per string, with overall maximum of 34A (limited by input current). Default: 3.4A per string
Charging	Internal battery: approximately 3 hours to 80% usable capacity at nominal line voltage after full load discharge External battery: no more than 10x discharge time to 90% usable capacity at nominal line voltage after full load discharge
Start-on-Battery	Allows start of UPS without utility input
Performance	ABM technology increases battery service life, optimizes recharge time, and provides a warning before the end of useful battery life
Protection	Extended Battery Module output protected by 100A circuit breaker

Table 22. Battery Runtimes (in Minutes) at Full Load

2-High Cabinets					
Load	32 Internal UPS Batteries	(1) EBM-64	(2) EBM-64	(3) EBM-64	(4) EBM-64
15 kVA/13.5 kW	4	23	43	65	88
12 kVA/10.8 kW	6	30	56	85	116
10 kVA/9 kW	8	37	69	106	144
8 kVA/7.2 kW	11	49	91	139	189
3-High Cabinets					
Load	64 Internal UPS Batteries	(1) EBM-96	(2) EBM-96	(3) EBM-96	
15 kVA/13.5 kW	13	43	76	113	
12 kVA/10.8 kW	18	56	101	149	
10 kVA/9 kW	22	69	124	184	
8 kVA/7.2 kW	29	91	164	242	

NOTE Battery times are approximate and vary depending on the load configuration and battery charge.

Chapter 14 Troubleshooting

The Powerware 9155 is designed for durable, automatic operation and also alerts you whenever potential operating problems may occur. Usually the alarms shown by the control panel do not mean that the output power is affected. Instead, they are preventive alarms intended to alert the user. Use the following troubleshooting chart to determine the UPS alarm condition.

Typical Alarms and Conditions

The following table describes typical alarms and conditions; check the Event Log through the control panel for a list of active alarms. If an alarm appears with a service code, please contact the help desk (see page 93).

Alarm or Condition	Possible Cause	Action
On Battery LED is on. 1 beep every second.	A utility failure has occurred and the UPS is in Battery mode.	The UPS is powering the equipment with battery power. Prepare your equipment for shutdown.
Battery Low LED is on. Continuous beep for 10 seconds.	The battery is running low.	Five minutes or less of battery power remains (depending on load configuration and battery charge). Save your work and turn off your equipment. When utility power is restored, the UPS restarts automatically, provides power to the load, and charges the battery.
Battery Breaker LED is on. 1 beep every second.	The UPS does not recognize the internal batteries.	Verify the battery circuit breaker is in the ON position. If the condition persists, contact your service representative.

Alarm or Condition	Possible Cause	Action
Overload LED is on. 1 beep every second.	Power requirements exceed the UPS capacity (greater than 100% of nominal; see page 87 for specific output overload ranges).	Remove some of the equipment from the UPS. The UPS continues to operate, but may switch to Bypass Mode if the load increases. The alarm resets when the condition becomes inactive.
Overtemperature LED is on. 1 beep every second.	UPS internal temperature is too high or the fan has failed.	If you have an optional Maintenance Bypass Module or Power Distribution Module, turn the Maintenance Bypass switch to the SERVICE position. Otherwise, shut down the UPS. Clear vents and remove any heat sources. Allow the UPS to cool. Ensure the airflow around the UPS is not restricted. If the alarm disappears, turn the Maintenance Bypass switch back to the UPS position (or restart the UPS if you do not have a switch). If the condition persists, contact your service representative.
Battery test failed	The batteries need service.	Contact your service representative.
The UPS does not start.	The main utility breaker is off.	Verify that the main utility breaker is on.
	If an optional isolation transformer is installed, the input circuit breaker is off.	Verify that the isolation transformer input circuit breaker is on.
	The Remote Emergency Power-off switch is active or the REPO connector is missing.	Reset the REPO switch and restart the UPS. Verify that the REPO connector is present.
Power is not available at the UPS output receptacles.	The UPS is in Standby mode.	Supply power to the connected equipment: Press any button on the front panel display to activate the menu options. Press the ↑ button on the front panel display and then press the → button to select the TURN UPS ON/OFF menu. Select the ON option. Press and hold the ↵ button for three seconds, until the UPS stops beeping.
The UPS does not provide the expected backup time.	The batteries need charging or service.	Apply utility power for 48 hours to charge the batteries. If the condition persists, contact your service representative.
	Battery circuit breakers are in the OFF position.	Switch all battery circuit breakers to the ON position.

Silencing the Alarm

Before silencing an alarm, check the alarm condition and perform the applicable action to resolve the condition.

Press any button on the front panel display to silence the alarm. If the alarm status changes, the alarm beeps again, overriding the previous alarm silencing.

Service and Support

If you have any questions or problems with the UPS, call your **Local Distributor** or the **Help Desk** at one of the following telephone numbers and ask for a UPS technical representative.

In the United States:	**1-800-843-9433** or **1-919-870-3028**
In Canada:	**1-800-461-9166**
All other countries:	**Call your service representative**

Please have the following information ready when you call for service:

- Model number
- Serial number
- Firmware version number
- Date of failure or problem
- Symptoms of failure or problem
- Customer return address and contact information

Two-Year Limited Warranty

Powerware Models: 9150, 9155, 9170+, and FERRUPS® 4.3–18 kVA (US and Canada)

WARRANTOR: The warrantor for the limited warranties set forth herein is Eaton Power Quality Corporation, a Delaware Corporation company ("Company").

LIMITED WARRANTY: This limited warranty (this "Warranty") applies only to the original end-user (the "End-user") of any Powerware 9150, 9155, 9170+, and FERRUPS 4.3–18 kVA Products (individually and collectively, the "Product") purchased on or after June 1, 2004 and cannot be transferred. This Warranty applies even in the event that the Product is initially sold by Company for resale to an End-user.

LIMITED WARRANTY PERIOD: The period covered by this Warranty for the Product installed [and currently located] in the fifty (50) United States, the District of Columbia, and Canada is twenty-four (24) months from the date of purchase for parts and ninety (90) days from the date of purchase for parts and labor, as further clarified in the following sections.

WHAT THIS LIMITED WARRANTY COVERS: The warrantor warrants that the Product and battery (individually and collectively, the "Warranted Items") are free of defects in material and workmanship. If, in the opinion of Company, a Warranted Item is defective and the defect is within the terms of this Warranty, Company's sole obligation will be to repair or replace such defective Warranted Item (including by providing service, parts and labor, as applicable), at the option of Company, and such repair or replacement shall be at either the End-user's location, Company's site, or such other location as determined by Company. All Warranted Items returned to Company and all parts replaced by Company shall become the property of Company. Expenses for any labor to repair the Warranted Item beyond the initial ninety (90) days are the sole responsibility of the End-user

PROCEDURES FOR REPAIR OR REPLACEMENT OF WARRANTED ITEMS when shipment is required of End-user: When Company determines that the Warranted Item will be repaired or replaced at a Company site or such other location, and the End-user must ship to Company the defective Warranted item, the following procedures are required.

If the Warranted Item is to be replaced by Company, and the End-user supplies a credit card number or purchase order for the value of the replacement product, Company will use commercially reasonable business efforts to ship (via standard ground shipment and at no cost to the End-user) the replacement Warranted Item to the End-user within one (1) business day after Company receives notice of the warranty claim. In such case, the End-user must return (at Company's expense) the defective Warranted Item to Company in the same packaging as the replacement Warranted Item received by the End-user or as otherwise instructed by Company. If Company does not receive the defective Warranted Item, Company will either charge the End-user's credit card, or send the End-user an invoice (which the End-user agrees to pay), for the value of the replacement product.

If the Warranted Item is to be replaced by Company, but the End-user is unwilling or unable to supply a credit card number or purchase order for the value of the replacement product, Company will use commercially reasonable business efforts to ship (via standard ground shipment and at no cost to the End-user) the replacement Warranted Item to the End-user within one (1) business day after Company receives the defective product from the End-user.

In any case, Company will provide shipping instructions and will pay its designated carrier for all shipping charges for return of defective equipment and replacement of Warranted Items. Any returned Warranted Item or parts that are replaced may be new or reconditioned. All Warranted Items returned to Company and all parts replaced by Company shall become the property of Company.

WHAT THIS LIMITED WARRANTY DOES NOT COVER: This Warranty does not cover any defects or damages caused by: (a) failure to properly store the Product before installation, including the charge of batteries no later than the date indicated on the packaging; (b) shipping and delivery of the Product if shipping is FOB Factory; (c) neglect, accident, abuse, misuse, misapplication, or incorrect installation; (d) repair or alteration not authorized in writing by Company personnel or performed by an authorized Company Customer Service Engineer or Agent; (e) improper testing, operation, maintenance, adjustment, or modification of any kind not authorized in writing by Company personnel or performed by an authorized Company Customer Service Engineer or Agent; or (f) use of the Product under other than normal operating conditions or in a manner inconsistent with the Product's labels or instructions.

This Warranty is not valid if the Product's serial numbers have been removed or are illegible. Any Warranted Items repaired or replaced pursuant to this Warranty will be warranted for the remaining portion of the original Warranty subject to all the terms thereof.

Company shall not be responsible for any charges for testing, checking, removal or installation of Warranted Items.

COMPANY DOES NOT WARRANT EQUIPMENT NOT MANUFACTURED BY COMPANY. IF PERMITTED BY THE APPLICABLE MANUFACTURER, COMPANY SHALL PASS THROUGH SUCH MANUFACTURER'S WARRANTIES TO END-USER.

COMPANY DOES NOT WARRANT SOFTWARE, INCLUDING SOFTWARE EMBEDDED IN PRODUCTS, THAT IS NOT CREATED BY COMPANY. WITHOUT LIMITING THE FOREGOING, COMPANY SPECIFICALLY DOES NOT WARRANT SOFTWARE (SUCH AS LINUX) THAT WAS CREATED USING AN "OPEN SOURCE" MODEL OR IS DISTRIBUTED PURSUANT TO AN OPEN SOURCE LICENSE.

THIS WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY OFFERED BY COMPANY WITH RESPECT TO THE PRODUCTS AND SERVICES AND, EXCEPT FOR SUCH FOREGOING WARRANTY COMPANY DISCLAIMS ALL OTHER WARRANTIES INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY, TITLE, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE. CORRECTION OF NON-CONFORMITIES IN THE MANNER AND FOR THE PERIOD OF TIME PROVIDED ABOVE SHALL CONSTITUTE COMPANY'S SOLE LIABILITY AND END-USER'S EXCLUSIVE REMEDY FOR FAILURE OF COMPANY TO MEET ITS WARRANTY OBLIGATIONS, WHETHER CLAIMS OF THE END-USER ARE BASED IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY), OR OTHERWISE.

LIMITATION OF LIABLITY: The remedies of the End-user set forth herein are exclusive and are the sole remedies for any failure of Company to comply with its obligations hereunder. In no event shall Company be liable in contract, in tort (including negligence or strict liability) or otherwise for damage to property or equipment other than the Products, including loss of profits or revenue, loss of use of Products, loss of data, cost of capital, claims of customers of the End-user or any special, indirect, incidental or consequential damages whatsoever. The total cumulative liability of Company hereunder whether the claims are based in contract (including indemnity), in tort (including negligence or strict liability) or otherwise, shall not exceed the price of the Product on which such liability is based.

Company shall not be responsible for failure to provide service or parts due to causes beyond Company's reasonable control.

END-USER'S OBLIGATIONS: In order to receive the benefits of this Warranty, the End-user must use the Product in a normal way; follow the Product's operation and maintenance manual; and protect against further damage to the Product if there is a covered defect.

OTHER LIMITATIONS: Company's obligations under this Warranty are expressly conditioned upon receipt by Company of all payments due to it (including interest charges, if any). During such time as Company has not received payment of any amount due to it for the Product, in accordance with the contract terms under which the Product is sold, Company shall have no obligation under this Warranty. Also during such time, the period of this Warranty shall continue to run and the expiration of this Warranty shall not be extended upon payment of any overdue or unpaid amounts.

COSTS NOT RELATED TO WARRANTY: The End-user shall be invoiced for, and shall pay for, all services not expressly provided for by the terms of this Warranty, including without limitation, site calls involving an inspection that determines no corrective maintenance is required. Any costs for replacement equipment, installation, materials, freight charges, travel expenses or labor of Company representatives outside the terms of this Warranty will be borne by the End-user.

OBTAINING WARRANTY SERVICE: In the USA, call the Customer Reliability Center 7x24 at 800-843-9433. Outside of the USA, contact your local Powerware product sales or service representative, or call the Customer Reliability Center in the USA at 919-870-3028. For comments or questions about this Warranty, write to the Customer Quality Representative, 3301 Spring Forest Road, Raleigh, North Carolina 27616 USA.

Extended Ten-Year Pro-Rated Limited Warranty

Applies *only* to original purchasers for end use in the United States and Canada who file the Warranty Registration Card within 30 days of purchase.
Powerware Models: 5115, 5125, 5140, 9104, 9120, 9125, 9155, 9170+, and FERRUPS

WARRANTOR: The warrantor for the limited warranties set forth herein is Eaton Power Quality Corporation, a Delaware Corporation company ("Company").

LIMITED WARRANTY: This pro-rated limited warranty (this "Warranty") applies only to the original End-user (the "End-user") of any Powerware 5115, 5125, 5140, 9104, 9120, 9125, 9155, 9170+, and FERRUPS Products (individually and collectively, the "Product") and cannot be transferred. This Warranty applies even in the event that the Product is initially sold by Company for resale to an End-user.

WHAT THIS WARRANTY COVERS: In addition to the standard Two-Year Limited Warranty covering the applicable Product, the warrantor warrants that the Product will have a service life (defined below) of Ten years from the date of purchase (the "Ten-Year Service Life") when used in accordance with the storage, handling, installation, operation and maintenance procedures prescribed in the Product's operation and maintenance manual. "Service life" means the Product's ability to deliver at least 80% of its original rated backup time.

If Company finds, in its sole discretion, that any Product has not provided the Ten-Year Service Life, Company will, as its sole obligation and the End-user's sole remedy for Company's breach of this warranty, repair or replace the Product, at its option, F.O.B. Company's factory, for a charge, payable by the End-user to Company pro-rated on the following basis:

The End-user will be allowed a credit against Company's list price of equivalent equipment at the time of return of the Product to Company, in proportion to the percentage of Ten-Year Service Life remaining at the time of return of the Product to Company. In calculating the available credit, the remaining portion of the Ten-Year Service Life will be rounded up or down to the nearest whole year. The End-user will assume responsibility to pay the balance of the list price; and Company reserves the right to require payment prior to delivery of the repaired or replacement equipment.

For the avoidance of doubt, Company's responsibilities under this Warranty are as follows:

Years 1-2 - Product repaired or replaced pursuant to terms of Limited Warranty

Years 3-10 - $\text{Credit (\$)} = \text{Current List Price} \times \frac{\text{Years of Unexpired Life}}{\text{10 Years of Warranted Life}}$

WHAT THIS LIMITED WARRANTY DOES NOT COVER: This Warranty does not cover any defects or damages caused by: (a) failure to properly store the Product before installation, including the charge of batteries no later than the date indicated on the packaging; (b) shipping and delivery of the Product if shipping is FOB Factory; (c) neglect, accident, abuse, misuse, misapplication, or incorrect installation; (d) repair or alteration not authorized in writing by Company personnel or performed by an authorized Company Customer Service Engineer or Agent; (e) improper testing, operation, maintenance, adjustment, or modification of any kind not authorized in writing by Company personnel or performed by an authorized Company Customer Service Engineer or Agent; or (f) use of the Product under other than normal operating conditions or in a manner inconsistent with the Product's labels or instructions.

This Warranty is not valid: (a) unless the End-user returns to Company the Warranty Registration Card within thirty (30) days of purchase; or (b) if the Product's serial numbers have been removed or are illegible. Any Warranted Items repaired or replaced pursuant to this Warranty will be warranted for the remaining portion of the original Warranty subject to all the terms thereof.

Company shall not be responsible for any charges for testing, checking, removal or installation of Warranted Items.

COMPANY DOES NOT WARRANT EQUIPMENT NOT MANUFACTURED BY COMPANY. IF PERMITTED BY THE APPLICABLE MANUFACTURER, COMPANY SHALL PASS THROUGH SUCH MANUFACTURER'S WARRANTIES TO END-USER.

COMPANY DOES NOT WARRANT SOFTWARE, INCLUDING SOFTWARE EMBEDDED IN PRODUCTS, THAT IS NOT CREATED BY COMPANY. WITHOUT LIMITING THE FOREGOING, COMPANY SPECIFICALLY DOES NOT WARRANT SOFTWARE (SUCH AS LINUX) THAT WAS CREATED USING AN "OPEN SOURCE" MODEL OR IS DISTRIBUTED PURSUANT TO AN OPEN SOURCE LICENSE.

THIS WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY OFFERED BY COMPANY WITH RESPECT TO THE PRODUCTS AND SERVICES AND, EXCEPT FOR SUCH FOREGOING WARRANTY COMPANY DISCLAIMS ALL OTHER WARRANTIES INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY, TITLE, NON-INFRINGEMENT, AND FITNESS FOR A PARTICULAR PURPOSE. CORRECTION OF NON-CONFORMITIES IN THE MANNER AND FOR THE PERIOD OF TIME PROVIDED ABOVE SHALL CONSTITUTE COMPANY'S SOLE LIABILITY AND END-USER'S EXCLUSIVE REMEDY FOR FAILURE OF COMPANY TO MEET ITS WARRANTY OBLIGATIONS, WHETHER CLAIMS OF THE END-USER ARE BASED IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY), OR OTHERWISE.

LIMITATION OF LIABLITY: The remedies of the End-user set forth herein are exclusive and are the sole remedies for any failure of Company to comply with its obligations hereunder. In no event shall Company be liable in contract, in tort (including negligence or strict liability) or otherwise for damage to property or equipment other than the Products, including loss of profits or revenue, loss of use of Products, loss of data, cost of capital, claims of customers of the End-user or any special, indirect, incidental or consequential damages whatsoever. The total cumulative liability of Company hereunder whether the claims are based in contract (including indemnity), in tort (including negligence or strict liability) or otherwise, shall not exceed the price of the Product on which such liability is based.

Company shall not be responsible for failure to provide service or parts due to causes beyond Company's reasonable control.

END-USER'S OBLIGATIONS: In order to receive the benefits of this Warranty, the End-user must use the Product in a normal way; follow the Product's operation and maintenance manual; and protect against further damage to the Product if there is a covered defect.

OTHER LIMITATIONS: Company's obligations under this Warranty are expressly conditioned upon receipt by Company of all payments due to it (including interest charges, if any). During such time as Company has not received payment of any amount due to it for the Product, in accordance with the contract terms under which the Product is sold, Company shall have no obligation under this Warranty. Also during such time, the period of this Warranty shall continue to run and the expiration of this Warranty shall not be extended upon payment of any overdue or unpaid amounts.

COSTS NOT RELATED TO WARRANTY: The End-user shall be invoiced for, and shall pay for, all services not expressly provided for by the terms of this Warranty, including without limitation, site calls involving an inspection that determines no corrective maintenance is required. Any costs for replacement equipment, installation, materials, freight charges, travel expenses or labor of Company representatives outside the terms of this Warranty will be borne by the End-user.

OBTAINING WARRANTY SERVICE: In the USA, call the Customer Reliability Center 7x24 at 800-843-9433. Outside of the USA, contact your local Powerware product sales or service representative, or call the Customer Reliability Center in the USA at 919-870-3028. Company will not accept any product for return, credit or exchange unless expressly authorized by Company in writing and delivered FOB Company factory. For comments or questions about this Warranty, write to the Customer Quality Representative, 3301 Spring Forest Road, Raleigh, North Carolina 27616 USA.

Load Protection Guarantee

Powerware Models 3110, 3115, 5115, 5125, 9120, 9125, 9150, 9155, 9170+, and FERRUPS (US and Canada)

GUARANTOR: The guarantor for the load protection guaranty set forth herein is Eaton Power Quality Corporation, a Delaware Corporation company ("Company").

LIMITED GUARANTY: This load protection guaranty (this "Guaranty") applies only to the original End-user (the "End-user") of any Powerware 3110, 3115, 5115, 5125, 9120, 9125, 9150, 9155, 9170+, and FERRUPS Products (individually and collectively, the "Product") and cannot be transferred. This Guaranty applies even in the event that the Product is initially sold by Company for resale to an End-user.

WHAT THIS GUARANTY COVERS: For the lifetime of the Product, guarantor promises to repair or replace, at guarantor's option, the equipment (valued up to the limits shown below*) that is damaged by an AC power line surge, spike, or other transient when properly connected to guarantor's uninterruptible power system ("UPS"). Reimbursement for or restoration of data loss excluded. This Guaranty applies only if all of the following circumstances arise:

1. The UPS is plugged in properly grounded and wired outlets, using no extension cords, adapters, other ground wires or other electrical connectors;
2. The installation of the UPS complies with all applicable electrical and safety codes described by the National Electric Code (NEC);
3. The UPS was used under normal operating conditions and in accordance with all labels and instructions; and
4. The UPS was not damaged by accident (other than AC power line transient), misuse, or abuse.

***Cumulative Limits to be paid by Guarantor under this Load Protection Guaranty:**

- $25,000 for Powerware Models 3110 and 3115
- $150,000 for Powerware Models 5115 and 5125
- $250,000 for Powerware Models 9120, 9125, 9150, 9155, 9170+, and FERRUPS products

WHAT THIS GUARANTY DOES NOT COVER: Any reimbursement or repair to End-user's equipment does not include reimbursement for or restoration of any data loss. This Guaranty does not cover any defects or damages caused by: (a) failure to properly store the Product before installation, including the charge of batteries no later than the date indicated on the packaging; (b) shipping and delivery of the Product if shipping is FOB Factory; (c) neglect, accident, abuse, misuse, misapplication, or incorrect installation of Product; (d) repair or alteration of Product not authorized in writing by Company personnel or performed by an authorized Company Customer Service Engineer or Agent; (e) improper testing, operation, maintenance, adjustment, or modification of any kind to the Product not authorized in writing by Company personnel or performed by an authorized Company Customer Service Engineer or Agent; or (f) use of the Product under other than normal operating conditions or in a manner inconsistent with the Product's labels or instructions.

This Guaranty is not valid: (a) unless the End-user returns to Company the Warranty Registration Card within thirty (30) days of purchase; or (b) if the Product's serial numbers have been removed or are illegible.

Company shall not be responsible for any charges for testing, checking, removal or installation of any items.

LIMITATION OF LIABILITY: THE REMEDIES OF THE END-USER SET FORTH HEREIN ARE EXCLUSIVE AND ARE THE SOLE REMEDIES FOR ANY FAILURE OF COMPANY TO COMPLY WITH ITS OBLIGATIONS HEREUNDER. EXCEPT AS OTHERWISE PROVIDED FOR IN THIS GUARANTY, IN NO EVENT SHALL COMPANY BE LIABLE IN CONTRACT, IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY) OR OTHERWISE FOR DAMAGE TO PROPERTY OR EQUIPMENT OTHER THAN THE PRODUCTS, INCLUDING LOSS OF PROFITS OR REVENUE, LOSS OF USE OF PRODUCTS, LOSS OF DATA, COST OF CAPITAL, CLAIMS OF CUSTOMERS OF THE END-USER OR ANY SPECIAL, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES WHATSOEVER. THE TOTAL CUMULATIVE LIABILITY OF COMPANY HEREUNDER WHETHER THE CLAIMS ARE BASED IN CONTRACT (INCLUDING INDEMNITY), IN TORT (INCLUDING NEGLIGENCE OR STRICT LIABILITY) OR OTHERWISE, SHALL NOT EXCEED THOSE SET FORTH ABOVE. Company shall not be responsible for failure to provide repair or replacement under this Guaranty due to causes beyond Company's reasonable control.

END-USER'S OBLIGATIONS: In order to receive the benefits of this Guaranty, the End-user must use the Product in a normal way; follow the Product's operation and maintenance manual; and protect against further damage to the Product if there is a covered defect.

OTHER LIMITATIONS: Company's obligations under this Guaranty are expressly conditioned upon receipt by Company of all payments due to it (including interest charges, if any). During such time as Company has not received payment of any amount due to it for the Product, in accordance with the contract terms under which the Product is sold, Company shall have no obligation under this Guaranty.

COSTS NOT RELATED TO GUARANTY: The End-user shall be invoiced for, and shall pay for, all services not expressly provided for by the terms of this Guaranty, including without limitation, site calls involving an inspection that determines no corrective maintenance is required. Any costs for replacement equipment, installation, materials, freight charges, travel expenses or labor of Company representatives outside the terms of this Guaranty will be borne by the End-user.

TO MAKE A CLAIM: In the USA, call the Customer Reliability Center 7x24 at 800-843-9433. Outside of the USA, contact your local Powerware product sales or service representative, or call the Customer Reliability Center in the USA at 919-870-3028. For comments or questions about this Load Protection Guaranty, write to the Customer Quality Representative, 3301 Spring Forest Road, Raleigh, North Carolina 27616 USA.